JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON.

VOL. CXVIII., No. 2553.—TUESDAY, APRIL 16, 1912.

EDITORIAL NOTES.

In a Scheme of Refinement.

THE Ideal Home Exhibition has been, since it started a few years since, one of the most popular display events of the year; and every year seems to increase its popularity. It is highly desirable that in an exhibition, dealing with the interests of the home, gas lighting, heating, and cooking should be represented; and this year the gas industry is there represented remarkably well—thanks to the enterprise of the South Metropolitan Gas Company, who have taken upon themselves to demonstrate that modern gas lighting and heating, and the fittings available therefor, are compatible with the highest and best forms of house decoration and equipment. Gas lighting once earned a very bad name—in the days when it was used in the crudest fashion, and in the days when gas was heavily enriched to raise its luminosity. We cannot say that any claim to irreproachability for gas in those days can be defended; and yet was it not from those days, and the earliest of those days, that some of the very choicest of decoration and art in general appointments were found in the houses of the wealthy? There is no doubt, however, that gas did earn for itself a bad name that, under new conditions, has partially clung to it without propriety.

But we are of opinion that gas in its flat-flame days was blamed beyond its deserts. The soiling of ceilings and walls was greatest during the long-hour lighting days. Rich gas was then burned in large amount from a number of crude burners, and not always completely burned; and there were strong highly heated currents, containing water vapour, from the flames flowing upwards, and carrying with them the dust in suspension in the atmosphere. Those were the days of solid fuel, and days when there was less knowledge than now of how solid fuel should be burned. The open solid-fuel fires contributed materially to the dust in the atmosphere of a room, and were therefore important contributors to, or allies of the open luminous gas-flames in, the disfigurement occasioned by the soiling of ceilings and the upper parts of walls. Nevertheless, gas lighting was then blamed for it all.

There has been a metamorphosis in conditions. By the incandescent burner, gas of less richness is required; and perfect combustion can be secured. With small or even medium units of inverted lamps, with properly constructed tops so as to prevent direct upward heated currents, and using gas-fires which keep the air of the room free from the dust and smoke of the open coal fire, ceilings and all parts of a room can be kept beautifully clean for as long as, and longer than, the sanitary conditions or the fading of colours do not demand redecoration. But we still occasionally meet with the existence of the old reputation that was earned for gas by the crude method of use and the conditions under which it was used. The competitors of gas try to fasten to the new conditions the old reputation. In this they must fail. About the ethical side of such commercial procedure, we need not say anything. But the best way to defeat fabrication of the kind is to demonstrate the contrary, and that too is the best means of dispelling any remaining misconception from the public mind. This the South Metropolitan Gas Company are now doing at the Ideal Home Exhibition; and they are showing there, too, that gas-fittings can be adopted and applied so as to aid in, instead of detract from, schemes of decoration produced by real art and the purest taste. The manifold conveniences of gas are also demonstrated. Among its competitors, there is not one that can present a similar range of convenience, of efficiency, and of economy. This is demonstrated by the display at the Olympia exhibition. The ideal home cannot do without gas, simply because the absence of the conveniences and comforts of gas removes from it certain conditions that give the home a complete title to the description "ideal."

Back to Work, and Strike Effects.

THE country breathed more freely at the beginning of last week, when it fully realized that the result of the National Conference of the Miners' Federation the previous Saturday was that the coal-pits of the country would be soon again yielding their normal supplies of fuel. The voting was expressive of the real feeling among the miners, and of the comparatively insignificant strength of the extremists who were for continuing the strike. Out of the total votes, they commanded rather less than 25 per cent.—that is to say 125, against 440 in favour of the immediate resumption of work. These extremists who have done their best to carry their fanaticism to the bitter end, to arouse the worse passions in the rank-and-file, and to injure the country further than has already been done through its people, their homes, and industries, may count themselves badly beaten. Owing to them the war was latterly waged round impossibilities; and for those impossibilities, although the main principle over which the strike originally took place had been gained, they sought to prolong the ruinous course into which they had directed the material concerns of the country. The country will not forget this; the large proportion of the miners represented by the majority vote will not soon cast from their minds the knowledge as to who were their best friends among the leaders in this matter. Had the best friends and counsellors of the men among the leaders been free from the trammels of what must have become an irksome and unwelcome and yet, by circumstances, forced companionship, there is good reason to believe the strike would have ended sooner, the money lost through the voluntary and compulsory cessation of a large part of the earning power of the labour of the country would not have reached the remarkable figures that it has done, and much distress (made the heavier and more acute every day the strike continued) would have been vastly lightened. The inhumanity that has been displayed through the delight of a few individuals to wield power that is world-attracting, and through the delight found in carrying mischief to—is it too much to say?—fiendish lengths is beyond adequate portrayal in conventional terms.

But the strike is at an end; and there is a disposition now to let, without crimination, matters quietly adjust themselves, and restore the country's work and daily habits to normal conditions. It has been a memorable strike in more senses than its length, and burdensome consequences. It has resulted in the enforced recognition of a minimum wage for labour in one section of industry—a condition of things that is opposed to the economic and other laws that should regulate affairs in industrial and commercial life. The influence of the establishment of this new principle is already permeating other quarters in the labour world; and the first signs of movement to make it a common plank in the labour platform have already appeared. The great army of labour represented in this strike has to its credit—this is one of the pleasant features of the remarkable and deplorable event—the fact that, with the exception of small sporadic outbursts, the rank and file have not yielded to the passionate violence and destruction that have disgraced previous fights for ends that they have conceived to be their due. On the other hand, the national strike has shown the greater power wielded by labour through it than by local strikes with unlimited rioting and law-breaking. The national strike, however, potent as it is on the one side, is, on the other, a malignant and powerful evil, so much so that the menace it offers to the country would be a sufficient vindication of a legislative movement, on the lines of the Antipodes legislation, to deal with persons and organizations that promote these attacks on the commonweal. But for labour the national strike, while potent in one direction, is crippling for a period to the exercise of the consolidated power. Several of the district organizations of the miners are now without funds; and the men are to-day faced with the knowledge (the country will not be sympathetic) that the days will be many before their financial reserves will permit them to enter upon a war of

such length as the one we have just passed through. War on the large scale has to be paid for on the large scale; and when income is not on commensurate lines, there can only be one result. That result many of the miners' unions have experienced; and the members of these particular unions have to-day no cause to be grateful to the ultraistic section of their leaders who caused the protraction of the concluding and inevitable stage in the struggle.

In the effects of the strike, there are other matters that will make it memorable. The Board of Trade returns as to our foreign trade afford some indication of the magnitude of the loss that has been occasioned to the coal industry, though alleviated by the largeness of the trade done prior to the actual strike. The coal exports during March only amounted to 1,655,145 tons—a decrease of 3,925,723 tons. The value was £1,131,992—a decrease of £2,053,699. The shrinkage in quantity was therefore 70·34 per cent.; and in value, 64·46 per cent. Taking, however, the three months ending with March, the exports of coal, coke, and manufactured fuel show a reduction of £996,350, which points to the rush for coal from abroad prior to the strike. But the tale for the opening days of this month has yet to be told; the tale has yet to be told of the (for perhaps some weeks to come) inequality of coal supply to demand; the tale has yet to be told as to the lessened consumption of coal that diminished requirement through enforced idleness has occasioned in the industries and the transport services of our country, and through the fuel economies in all quarters; and the tale has yet to be told (if ever it can be) as to the extent that coal and other contracts have been transferred from this country to others. Until the whole statistical history of the strike is before us, there can be no full appreciation of what has really happened. Certainly there can be no definite measure of the colossal irrecoverable loss the country has suffered.

Now that the strike is ended, some credit may be put to the account of the gas industry for the excellent generalship that was displayed by the accumulation of the necessary reserves for meeting a national coal strike of such duration. In comparatively few places, had any of the services to the public and private consumers to be curtailed, though the consumption is now spread over the greater number of hours of the day. In a few places, the public lighting was reduced; in two or three cities and towns, there was a partial cessation of the supply, or rather the mains during part of the day were kept under very low pressure. But the well-advertised examples of this had a very small relation to the total gas undertakings in the United Kingdom. The community will not forget the way the gas industry met its obligations during this unprecedented condition of affairs; and, should such another disturbance overtake the country —either coal or transport—given the time now, the community will again not find the industry wanting. A little time will be required before regular deliveries are secured, and before gas undertakings are able to recuperate in the matter of stocks. But the chief lesson to the industry is that it will never do to again rely on any old standard in the matter of coal storage. Labour policy now rules otherwise. The enlarged methods of labour warfare must mean enlarged coal reserves. For the moment, the great and satisfactory thing is that the miners are at work again.

Parliamentary Powers and Competition.

The Gaslight and Coke Company have just obtained from the Court of Referees a declaration that they have a right to be heard on the ground of competition in connection with the Bill the West Ham Borough Council have in Parliament this session; and the Court have very good reason behind them for having given their consent. Part of the electricity industry are trying, as opportunity occurs, to secure from Parliament extraordinary roving powers in regard to electricity supply and competition. They want to go to work without any control upon their own actions, and without any protection for the ratepayers. "Unbridled "speculation" is their present motto. It is written plain as anything can be across the front of the Municipal Electrical Association's Bill. It is also written plain as it can be over the electrical clauses of the West Ham Bill. Both measures are excellent illustrations of the necessity for gas companies being constantly on the *qui vive* to ensure that, in the applications to Parliament or the Local Government Board, the local authorities are not endeavouring to broaden their limits in the matter of trading powers. The West Ham Corporation are asking for new powers regarding the supply and installation of wires, meters, fittings, engines, machinery, apparatus, and appliances of any description for electrical energy; and the authority they seek is so wide that they would have saved the use of many unnecessary words, and the tenancy by clauses of much space in the Bill, if they had simply inserted a single line decreeing that the undertakers in the present case may do precisely as they please in respect of the various appliances already mentioned.

The Gaslight and Coke Company object to the powers being granted. They are not only competitors in West Ham, but they are ratepayers of considerable magnitude, and, being so, they have a deep interest in such questions as local municipal speculation and extraordinary trading powers. They object *in toto* to the electrical clauses in the Bill; but if they are not successful in overthrowing them, they desire to get the Bermondsey clause, or the Northumberland form of the clause, applied. We have an instance here of the flexibility of the learned gentlemen of the Parliamentary Bar. Mr. Balfour Browne, K.C., announces his intention of resisting, on behalf of the West Ham Corporation, the insertion of the Bermondsey clause or its successor. The Bermondsey clause takes its name from the very first Electric Lighting Order in which such control was inserted; it was Mr. Balfour Browne's argument, on behalf of the South Metropolitan Gas Company, that obtained its insertion; and we think the learned leader can claim the parentage of the clause. Perhaps it will be said this is an instance of circumstances altering cases. We know of no circumstances that justify the claim that the West Ham Borough Council should be accorded the licence for which they are asking. If these clauses are only intended to effect the simple purpose of changing the method by which the Electricity Department can be paid, it would hardly be worth while the Borough Council fighting over them, or Mr. Balfour Browne offering any strong resistance to the Gaslight and Coke Company. Demeanour, action, and statement are not of equal weight. The reason advanced for the existence of the clauses has very much the nature of a thin disguise to what is actually the case. So apparently thought the members of the Court of Referees; and the Gaslight and Coke Company were granted their *locus*.

Tar Elimination from Water Gas.

An investigation regarding the efficiency of various purifying plants in the matter of the removal of tar from carburetted water gas has been made at New Haven (Conn.); and the results have been embodied in a paper read by Dr. A. P. Beardsley before the New England Association of Gas Engineers. The results, however, cannot be accepted as conclusive, but only as applying to the particular conditions of temperature and make, and make in relation to the size of the plant, that he describes. Rate of flow and time-contact must be taken into consideration, as these have an important bearing upon the efficiency of certain of the plant in performing this particular function of the removal of tar. All these conditions have a contributory influence upon the results obtained in any such investigation, the importance of which, however, cannot be disputed, having regard to the fact that, upon the tar-eliminating efficiency of the plant preceding the purifiers, the life and efficiency of the material in the vessels will largely depend. The investigation is suggestive. It is not an investigation beset with very many difficulties; but it has to be carried out under a variety of circumstances in relation to temperature (which has an effect upon the quantity of tar present as vapour), the size of plant, volume of make, rate of flow, pressure, and time-contact, before making any definite deductions as to the relative efficiency of plant for this particular purpose.

Under the conditions that we have in the paper before us, there are presented by Dr. Beardsley the results of tests as to the removal of the tar in five different stages—in the board scrubber, the condensing system, by the Pelouze and Audouin extractor, in scrubbers filled with shavings, and in the purifiers. There are various weak spots in the paper, as the author clearly realizes. He takes especial care not to speak too positively on any one point; but all the way through there is a sufficient amount of qualification to allow of subsequent change of view in the event of some different order of conditions altering the complexion of things as they now appear under the existing circumstances at New Haven, which conditions are not, says the author, "as we would

"in some cases like to have them." This clearly indicates the prospect of improvement. However, without quoting any of the figures here, the board scrubber as a tar extractor for water gas did not, as a result of the tests, seem to evoke any high esteem—it does not "appear" to be very effective as a tar extractor. In comparison with other means, this can be well understood. The condensing system, on the other hand, stands in high favour—more tar being taken out at this stage than in all the others combined. The Pelouze and Audouin extractor is apparently somewhat susceptible to pressure conditions; and pressure conditions with the extractor may make quite marked differences on the results. Coming to scrubbers containing shavings, here time-contact is a matter of importance; and in the tests the scrubbers did fairly satisfactorily at their rated capacity. But we rather think that, although the shavings scrubber occupies more space, and the costs of installation are rather greater, than in the case of the Pelouze and Audouin extractor, the author of the paper has a preferential leaning towards the shavings scrubber, inasmuch as he is "doubtful whether the work of the shavings scrubbers could be so well done by an additional extractor." So far, therefore, it may be taken that the condensing plant and the shavings scrubbers show the best results under the particular conditions of the experiments. Then it is found that the purifiers were very effective in filtering-out the tar fog. But, as has been already remarked, out of respect for the life and efficiency of the purifiers and for economy, every effort should be made to arrest the tar prior to the purifiers.

If the investigations lead to any improvement in the operations at New Haven in the matter of the removal of the tar, it is hoped that Dr. Beardsley will give a further account of his experiences, and of the relative efficiencies of the appliances under the altered circumstances. Meanwhile, the New Haven inquiry may engender a desire in other quarters to make similar research under different conditions. If so, we shall be glad to hear of the results.

Road Maintenance and Tar-Spraying.

ROAD surveyors and engineers who employ tar for road surfacing are already placing the resulting suppression of the dust nuisance in a secondary place to the important financial effects the practice has in savings on road scavenging, watering, and maintenance, and by keeping grit out of the sewers. From the financial view alone, surfacing and other use of tar on roads has become a real economic necessity. So much the better for tar; and so much the better also for the ratepayers. The latter ought to-day almost to bless the triturating effects of motor-car traffic and the dust nuisance for the eye-opening it has occasioned as to the best way of constructing and maintaining roads. The dust nuisance was indeed a friend in disguise. And it comes to this, that road authorities cannot to-day afford to ignore the use of tar. This is proved by some remarkable figures published in the ninth annual report of the Metropolitan Committee on Materials and Means of Paving the Streets of London. Some of the authorities in London, of course, deal almost entirely with paved streets; but there are certain others that have had better opportunity of putting to the test the economic efficacy of tar-surfacing. Where this has been the case, the advancing expenditure on tar application has produced savings in the three or four directions already mentioned, that are out of all proportion to the relatively small expenditure on tar, labour, and appliances. Wandsworth is an outstanding and convincing illustration. Excluding new wood-paving in 1906-7, £88,601 was spent on scavenging and other road services; while in 1910-11, the total was £51,805. This was a saving of £36,796—made up of a lower outlay on scavenging to the amount of £8712; watering, £5733; and maintenance, £22,351. During the same period, only £6731 was spent on tar-spraying; being a gradually increasing amount from £156 in 1907-8 to £3171 in 1910-11. This shows how comparatively insignificant is the expenditure to secure such a large saving as that referred to. The saving too, it must be borne in mind, is only the difference between the total outlay in one year and the outlay in twelve months five years before. In the years between, each one has seen savings aggregating many thousands of pounds. That in tar-surfacing there is a very substantial saving has gone past the stage of anticipation; it is a proved realization. And to-day road authorities everywhere cannot do without tar.

Dr. Davidson's Carbonization Studies.

On inquiry of the Secretary of the Midland Association of Gas Engineers and Managers (Mr. Harold E. Copp, of West Bromwich), we learn that the Committee last Thursday decided, owing to the pressure occasioned by the position created by the coal strike, to postpone the discussion on Dr. W. B. Davidson's paper read at the last meeting (together with the supplementary contributions already published, and to be published, in the "JOURNAL") until the autumn general meeting. Certain gentlemen who are not members of the Association have intimated their desire to take part in the discussion; and several members of the Association are also no doubt anxious to do the same. Dr. Davidson has provided material sufficient for a good sitting, without anything else. It would therefore be a pity to hasten the discussion, and probably spoil a full, critical, and instructive debate, by fixing upon a time that is as inopportune as the present. The Committee, we think all will agree, considering the importance of the subject, and the fact that other engagements are now close at hand—such as the annual meeting of the Institution—have wisely determined. In fixing up autumn engagements, however, the first annual meeting of the British Commercial Gas Association in Manchester will have to be taken into calculation by Committees of our other gas organizations

Suggested Additions to Gas Terminology.

In a recent number of the "Journal de l'Eclairage au Gaz," M. André Grebel offered suggestions for certain additions to gas terminology which he thinks are called for as the result of present-day methods of using and testing this useful illuminating and heating agent. He points out that while the measurement of the lighting and heating power of gas is well described by the words "photometry" and "calorimetry," there is no single word to describe the measurement of the element required for its complete combustion. Many who have attempted technical French translation have stumbled over the word "*comburant*" (from the Latin *comburere*, to burn), and have had to render it into English by a periphrasis—say, "supporter of combustion"—for want of a word. Taking the root of the verb, M. Grebel produces "comburimetry," the science of measuring the quantity of air or oxygen necessary for the complete combustion of gas; and "comburimeter," the instrument used for the purpose. These words are on the lines of "photometry," "photometer," "calorimetry," and "calorimeter." We now require a word to express the avidity of various combustibles for a greater or less quantity of the supporter of combustion; and M. Grebel suggests "comburivorous," which would be analogous to "fumivorous." Consequently, instead of saying, "Coal gas requires for its complete combustion more air or oxygen than hydrogen," we should say, "Coal gas is more comburivorous than hydrogen." Having gone so far, M. Grebel does not see any objection to the formation of the word "comburivority," as a companion to "combustibility." Supposing the foregoing suggestions were adopted, the "comburivorous power" of a gas would be the measure of its comburivority, or the quantity of the *comburant* (secondary air) necessary for complete combustion. M. Grebel asks why gas engineers should hesitate to adopt new expressions which have become indispensable in their industry, when they have before them the example of the electricians, whose *technique* is the more severe from the fact that its terminology is exact and concise.

Motor Cars and Main Road Lighting.

A short time since the "Westminster Gazette" raised the question, in relation to motoring, of the indifferent lighting of some of the arterial roads connecting large towns. The matter attracted the attention of the "Illuminating Engineer;" and in the columns of that periodical, the suggestion was made that some of the money at present applied to the upkeep of the road surfaces might fitly be devoted to experiments in lighting such roads. It is submitted by our contemporary that it will be generally admitted that one of the main purposes to be served by modern street illumination is the guidance of fast-moving traffic. The first suggestion betokens a narrow point of view. The author of it would sacrifice the interests of the many for the interests of the comparatively few. There is no objection to the highways connecting towns being illuminated with a regard to the general interests. It must not, however, be forgotten that the bulk of

the community who have to pay for the lighting of such roads do not ordinarily use them during the hours of darkness; and to saddle the whole of the ratepayers with additional expenditure, or to deprive them of money otherwise usefully applied, for the benefit of the comparatively few motorists who choose to travel such roads after dark, would not be just. As a matter of fact, many town residents would not be sorry if a time-limit was placed on the night use of motor cars, so that the members of households might retire to rest with some assurance that sleep would not be disturbed by the whirr and screechings that now make night hideous. There is no reason why more should be done to encourage motorists to turn night into day. The vast body of ratepayers who are not motorists would look unfavourably upon money now devoted to the upkeep of the surfaces of roads, and to securing relief from the dust plague, being diverted to lighting the at night time little-used highways beyond the cities and towns. The upkeep of roads is a matter affecting all people and all hours of the day; the lighting of those connecting roads, few people and few hours. The ratepayers will consider that, for the general community's welfare, it will be cheaper for the motorist who desires to travel after dark to provide himself with light sufficient for his own requirements and for the protection of the very few people who may be using the highway in a more leisurely fashion than the motorist usually displays.

Direct Recovery of Sulphate of Ammonia.

Perhaps there is more interest in this subject than is at present visible among gas engineers and chemists. If there is, there are very few indications of it; and therefore all the greater welcome is given to the annotations (published this week) of Mr. Arthur Douglas, B.Sc., upon the article we recently gave describing the patent that Mr. John Radcliffe had been successful in obtaining, in face of opposition before the Comptroller-General of Patents. As we pointed out, Mr. Radcliffe has carried the process of direct recovery of sulphate of ammonia a step farther than previous workers, by maintaining the temperature of the gas throughout the process sufficiently high to prevent the condensation of the water vapour, and this without aid from any auxiliary source of heat. Mr. Douglas welcomes a British inventor in the field; and his examination of the direct-recovery process leaves upon the reader's mind an impression that there is a favourable leaning on his part towards it. There are savings in labour and plant to be realized from it. But, *per contra*, purification for sulphuretted hydrogen and carbon dioxide would cost somewhat more, though not to the extent of the savings in labour and plant. There is the old fear as to the effect of the sulphuric acid on the illuminating power and the calorific qualities of the gas. There again, so far as his experiments have gone, Mr. Douglas does not find any but a negligible diminution of values. But this is a matter he is going to further check. However, what, as we have said before, is wanted is working proof of the advantage of the direct in comparison with the old separate system. Superficially, we may see benefits in a new system, and we may speculate about them; but there is no safe base except actual working for unqualified approval or dismissal as impracticable.

German Association of Gas and Water Engineers.

It is officially announced that the fifty-third annual general meeting of this Association will be held at Munich from Monday, June 24, to Friday, June 28, under the presidency of Herr S. Kordt, the Manager of the Corporation Gas, Water, and Electricity Works at Dusseldorf. The programme of the arrangements for the meeting, with the list of technical communications, will be issued later. There will be no trade exhibition in connection with this year's meeting.

A New Storage Battery.—According to a telegram from the Copenhagen Correspondent of the "Daily Telegraph," Professor Hanover, President of the Polytechnic Academy in that city, has made a very important invention which is "expected" to produce a revolution in the electrical accumulator industry. He has devised accumulators which have five times larger electrical capacity than those at present existing, but are only of the same size and weight. The main point of the invention is stated to be to give a porous lead alloy, which the Professor has composed, and which he calls "pore metal," a larger capacity by perforating the lead sheets with millions of microscopic holes. The new accumulators, which are likely to be more expensive than those now in use, will be of special importance, among other things, for the lighting of railway cars.

OBITUARY.

CHARLES FREDERICK RUGGLES.

With a sorrow, intensified by the deepest personal regard, we have to announce the death, at the age of 63 years, of Mr. Charles Frederick Ruggles, of Leighton Buzzard. The sad event occurred last Friday. His intimate friends in the industry have known that for some time past he has not been enjoying good health; but his passing from their midst will cause real heartfelt regret. In the gas profession, our late friend had a high reputation for a zealous and conscientious devotion to the interests entrusted to him. The Chairman and Directors of the Leighton Buzzard Gas Company will miss the rigid faithful support of their trusted adviser and manager. Those who knew of the relations existing between the administration, the shareholders, the workers, and last, but not least, the customers of the Company, were well aware of how their best interests were the single aim of him who has passed hence. The works were a model for a moderate-sized undertaking, and embodied the views of a progressive mind. In Leighton Buzzard, the standing of our departed friend was of that order that is only obtained by genuine respect and admiration. In the gas profession, Mr. Ruggles was the friend of all. Those personal qualities of amiability and generosity—qualities that were reflected in the face of the man—yet in disposition retiring and never obtrusive, gained for him friendships, and lasting friendships, wherever he went. His tall, ample figure and kindly face were always to be seen at the meetings of the Institution of Gas Engineers, and at those of the Eastern Counties Gas Managers' Association. His presence and companionship were ever welcome at meetings, on the excursions—in fact, on all occasions. He favoured all co-operative work that, in his opinion, promised well for the general advantage of the gas industry. In 1908, he was the President of the Eastern Counties Gas Managers' Association; and the address he then delivered showed a broad practical view of the industry's domestic and commercial affairs. On more than this occasion, the members of the Association have been received at Leighton Buzzard; and they have individually and collectively always felt it good to go there. The influence of Mr. Ruggles was great in the locality. He asked, and the request was accorded; and so the genial welcome and hospitality ever awaited in the town visitors who were of the gas industry. Mr. Ruggles was a prominent member of the masonic fraternity in Bedfordshire; and he was a frequent visitor to the Evening Star Lodge. The deepest sympathy goes out to Mrs. Ruggles and her family. A devoted husband, father, and friend has passed from the home circle. There will be a funeral service to-morrow at All Saints' Church, Leighton Buzzard, at 3 o'clock; and the interment will take place at the cemetery shortly afterwards.

Dr. William Ogle, an eminent member of the medical profession, who served on the Royal Commission on Water Supply in 1892-3, with Lord Balfour of Burleigh as Chairman, died last Friday. He was in his eighty-fifth year.

The death occurred recently, at the age of 84, of Mr. John Pattinson, who was Public Analyst for the Corporation of Newcastle-on-Tyne and for a number of other authorities in the North of England. He was for some time connected with the ironworks of Messrs. Bell Bros., of Port Clarence, and began business as a Public Analyst in 1860. He was an ex-Vice-President of the Chemical Society and the Society of Public Analysts, Vice-President of the Newcastle Chemical Society, and the author of many scientific papers.

On the 8th inst., the death occurred of Professor Edward Divers, M.D., Hon. D.Sc., F.R.S., F.I.C., at his residence in Kensington. Dr. Divers, who was born in London in 1837, was one of the most distinguished chemists of his generation. He was educated at the City of London School, the Royal College of Chemistry, and Queen's College, Galway, and became a Fellow of the Chemical Society in 1860, and one of its Vice-Presidents in 1900. After lecturing on Medical Jurisprudence at the Middlesex Hospital, he became one of the band of celebrated English scientific and technical men selected in 1873 by the Japanese Government to form the teaching staff of the Imperial College of Engineering at Tokio. From the position of Professor of Chemistry he rose in 1882 to that of Principal of the College. On his retirement, he was elected Emeritus Professor of the Imperial University of Japan, and received the Second Class of the Order of the Sacred Mirror and the Third Class of the Order of the Rising Sun. He was an original member and a Past-President of the Society of Chemical Industry, and was a Vice-President of the Institute of Chemistry from 1905 to 1908, and one of its Censors in 1907 and 1908. He received his Fellowship of the Royal Society in 1885. Among his many contributions to chemical technology may be recalled the paper which he prepared, in collaboration with a Japanese research scholar, Tetsukichi Schimidzu, on the calcium hydrosulphides. This paper, which was presented to the Chemical Society in 1884, showed *inter alia* the constitution of the compound formed from slaked lime in sulphide purifiers; and the importance of this research work to the gas industry was emphasized at the time in the "Journal" [Vol. XLIV., p. 329]. The correctness of the conclusion of Dr. Divers as to the composition [Ca(OH)(SH)] of this compound was subsequently confirmed by Mr. V. H. Veley and other workers.

PERSONAL.

We learn that Mr. HUGH F. WRIGHT has resigned the position of General Manager of Messrs. C. & W. Walker, Limited, which he has filled for the past six years.

At Christ Church, Carnforth, last Wednesday, the marriage was solemnized of Mr. JOHN LUPTON, the Secretary of the Carnforth Gas Company, and Miss MABEL SHAW LAMBERT, daughter of a member of the Carnforth Urban District Council.

Mr. FRED. DAVIES, of the Brighouse Corporation Gas Department, has been appointed Working Manager of the Fazakerley Gas-Works of the Liverpool Corporation. Applications for the position were invited in the "JOURNAL" for Feb. 27.

Some weeks ago, applications were invited in our advertisement columns for the position of Accountant-Secretary of the Dartford Gas Company. We learn that Mr. C. F. WHITE, who is at the present time with Messrs. Wood, Drew, and Co., has been selected. He is 32 years of age.

From the list of candidates for the position of Assistant-Manager of the Helensburgh Corporation Gas-Works, three were selected for further consideration. Among them was Mr. DAVID FULTON, of the Dawsholm works of the Glasgow Corporation; and he has obtained the appointment. Mr. Fulton has been eight years in the service of the Corporation, and is the popular Hon. Secretary of the Western District Section of the Scottish Junior Gas Association.

At the close of the International Smoke Abatement Exhibition at the Royal Agricultural Hall on the 4th inst., Mr. F. W. BRIDGES, the Organizing Manager, was presented by the exhibitors with an illuminated address, in testimony of their appreciation of his services. It recorded the recognition by the donors of the exceptional difficulties Mr. Bridges had had to meet in consequence of the disastrous coal strike. Nevertheless the exhibition had been an unqualified success. The exhibitors fully realized that this result was due to Mr. Bridges' energy and ability; and they desired to inform him that his "uniform courtesy, tact, and attention" had been much appreciated by them and their representatives. These expressions were specially gratifying to Mr. Bridges, who has been the recipient of similar testimonials in connection with each exhibition he has organized and for which he has been personally responsible, during the past three years.

ELECTRICITY SUPPLY MEMORANDA.

How Electrical Editors Love One Another—Truth before Fiction—Price of Current for Heating, and Provision of Appliances—Grossly Unfair Charge Practices—The Wiring and Hiring Bill—Gas Tar to the Rescue—Lamp Tests—An Independent Cooking Test.

IT is impossible to compliment the Editor of "Electrical Engineering" upon his caustic censure of Mr. W. R. Cooper, who is described as Editor of the "Electrician," for having made, at the recent informal conference of the Institution of Electrical Engineers, what is considered by his journalistic *confrère* to be "an ill-advised attack on the application of electricity for heating and cooking." We cannot for the life of us see how telling the truth can be construed into "an ill-advised attack" on anything. However, the Editor of "Electrical Engineering" is very wrath over the matter, and regards what Mr. Cooper did as not only an ill-advised attack, but a "deliberate" one. It is not for us to add fuel to this particular fire; but we have our personal views as to which action constitutes the most "ill-advised" and "deliberate" attack—Mr. Cooper's remarks, or the brazing together, in the columns of a competing contemporary, of Mr. Cooper's private position and his professional one. The gravamen of Mr. Cooper's offence is that he spoke during the discussion in question of "the greater comfort of the coal fire . . . than an electric-heater for the continuous warming of a room;" and "he also referred to the cheapness of gas cooking, and the advantage of being able to obtain a gas-cooker on the hire-purchase system."

Turning to the report of the discussion in the columns of the "Electrician" (where it may be expected a faithful record or digest of Mr. Cooper's remarks is published), we see that he advised that, in the designing of an electric radiator to take the place of a fire, regard should be had to the possibility of highly heated surfaces being objectionable by reason of the combustion of organic matter upon them from the air. He also stated that, as a consumer, he used gas to a small extent for heating and cooking, simply because it was cheap to put in, and cheap to maintain on a hire or hire-purchase system. . . . He could not use gas completely for cooking, on account of the cost of obtaining hot water for the house." If Mr. Cooper approaches the local gas company upon this question of hot water supply, they will show him how gas can be used in conjunction with his ordinary hot-water circulating system, as and when required, without in any way interfering with the boiler arrangements in connection with the kitchen coal range. But respecting the other points, as to cooking and heating, it will be remembered that it was in the columns of the "Electrician" that Mr. Grogan (of "Tricity" electric-cooker fame) made his attack on the gas-cooker, and afterwards took refuge therein in making a lame defence and excuse for not categorically replying to our criticisms. It will also be remembered that the "Electrician" attempted to shield and support Mr. Grogan. But in consequence of this, do we bear the slightest animus towards Mr. Cooper or anyone else on the staff of the "Electrician"? Not a bit of it. Nor do we blame Mr. Cooper for speaking plainly, in the hall of the Institution of Electrical Engineers, as to his personal experience. This will have a more beneficial effect than tons of fiction. He cannot be charged with doing anything more than thousands of electric light users throughout the country do for precisely the same reasons. We do not suppose that he will feel any the worse for what appears to us to be somewhat ill-natured personal criticism on the part of a contemporary. Nor do we suppose that he is the person responsible for the statements in this week's issue of the "Electrician" that amount to charges of deliberate unfairness, and therefore of misrepresentation, on the part of Mr. Joseph Cash, Miss Weston, and Mr. Browne, in connection with the results of cooking tests published in our columns for the 2nd inst. The "Electrician" seems rather fond of passing judgment upon other people's actions, and levelling unjust accusations. The Westminster lighting is an example.

One is sensible of the fact that no agent for heating or other purpose can hope to succeed unless it is sold at a price that is a competitive one. For heating purposes, the electricians have not been able to get down to a figure that can compete with other heating agents; and nothing that they can do will enable them to produce electricity, and show through it any substantial part of the heating value that the fuel used in its production possessed. Although they have not got down to competitive figures, and cannot do so without loss, they have reduced the price offered to one that does not, in most cases, give anything but the most microscopic margin over works' costs, without reference to capital and administrative charges. This fact alone totally prevents, where power to do so exists, any indulgence being shown to electricity consumers in the matter of the supply of apparatus. For promoting the day-load of gas-works—gas being charged at lighting rates—several undertakings, out of the profits on the extra gas consumed, supply cookers free, while others do so at a nominal rent. Even assuming that suppliers of electricity generally had the power to supply and deal in electric wiring and fittings, they could not afford to follow the example of these gas undertakings with a price for current that is low enough to be truly a competitive one. The difference between such a price and costs effectually prohibits such a course. We see the awkward position of the electricity industry in this matter—a commodity of low heating value, price already whittled down to much below the average cost per unit (including works, capital, and administrative charges), and prices of appliances which, through their more intricate construction, are much above those of their gas competitors.

Mr. Francis Husband, Assoc.M.Inst.E.E., deals, in a letter to the electrical papers, with the point as to the apparatus. He says that the majority of domestic consumers have to consider, over and above the cost of energy, the cost of the necessary electrical appliances. At present, these have to be purchased outright by intending customers; and very few of them are able, or, if able, willing to pay (say) £14 for an electric oven, when the landlord gives a coal range for nothing, and the gas company supply a gas-cooker for 2s. 6d. per quarter. Moreover, the owner of the electric-oven has to pay all the expense of carriage, disconnection and reconnection, should he have to remove; and this without any certainty that his oven will suit the potential of the new district. Lately, too, in the "Memoranda" reference was made to the effect of an intermittent short-hour load (such as cooking) on the distribution, capital, and other charges. In the paper by Mr. W. W. Lackie, to which we referred last week, he made a calculation in which he showed that the short-hour consumers on the Glasgow distribution system represented a loss of £23,000 per annum; and this loss the more lucrative consumers had to make up. This is altogether unfair; as it follows that, if there were not this loss, the lucrative consumers could be supplied at a lower price. Electricians are adding to their knowledge with the passing years; and this knowledge must make them more and more conscious of the fact that domestic electrification is not such plain sailing as the extreme enthusiasts pretend.

As we were recently remarking, the low prices for power and heating are "coming home to roost" with a vengeance; and these low prices are tying the hands of electricity concerns under their present conditions in a manner (as already shown) that they did not anticipate. When a low price is offered for securing a certain class of business at the outset, it is one of the most difficult things in the world to make customers afterwards look agreeably upon a higher price, and yet a higher price may be necessary, not only because it is no longer possible to justify the exclusion of standing and other charges from the price they pay, but on account of the higher costs of fuel and labour. The inclination, however, of the consumers is bound to be towards a still lower rate. That is so in the case of electric power and heating consumers; and the interminable discussion of tariffs points to the fact that, for their own sakes as well as for promoting business, electricity concerns desire to see a revision of current tariffs that will do something to disguise a higher level of average charge. Mr. B. Welbourn makes a point not of the disguising, but of the revision, in an article in the "Electrician" on "Tariffs for Electricity Supply." He thinks it is grossly unfair to the lighting consumers—those poor long-suffering beasts of burden of the electricity supply industry!—that they should be saddled, as they have been, and are to a considerable extent to-day, with the standing charges.

The electric power user fed from the town mains has not the slightest care who pays the standing charges, so long as he does not. He seems to be an eminently selfish creature; but it is the electricity industry that has in this particular made him so. As Mr. Welbourn says, power users often expect impossible low rates; and they naturally cannot understand why the prices should go up, although new plant has been specially installed for them. "They do not grasp the reasons why they must carry their own standing charges, and cannot shelve the burden on to the lighting consumers." It would have been better to have written, "they naturally will not grasp the reasons," &c. On one big supply undertaking of which the writer has knowledge, 50 per cent. of the power business offered annually has to be refused because of the false ideas prevalent as to power rates. In the view of Mr. Welbourn, the flat-rate of the future, both for domestic and power users, will assume a different form, and will be a contract rate of so much per month, quarter, or year for an unlimited supply up to a given maximum demand—controllable by a special form of instrument.

Up to the adjournment of Parliament for the Easter recess, the electric wiring, hiring, unprecedented financial licence, and other powers Bill of the Incorporated Municipal Electrical Association had not been reintroduced. If it had been, the official papers told an untruth by omission. Perhaps Mr. H. Faraday Proctor, Hon. Secretary of the Association, will again write to the electrical papers to deny the present statement. It is a pity to appeal for further funds for the parliamentary campaign, when, even by the most powerful of electric search lights, the administrators of the electricity supply industry cannot trace the living existence of the measure anywhere on the parliamentary horizon. The Bill is going to take time to get through Parliament; and this session will be lost if the measure is not promptly set on its feet again.

It is wonderfully kind of Mr. W. C. Bexon, the Engineer and Manager of the Kilmarnock electricity works, to put in a good word for gas tar, as having some usefulness to electricity concerns in such stressful days in regard to fuel supply as those lately passed through. If the electricity industry had consummated their much-cherished hope of snuffing out the gas industry, Mr. Bexon would not have been able to write to the "Electrical Review," as he has done, in praise of gas tar as a fuel. He has fitted one of his water-tube boilers with the necessary apparatus for burning tar. It has only cost him £2; and the arrangement has accomplished its purpose far beyond expectations. On working out the cost of gas tar as a fuel, he finds it to be little more than the cost of coal at an extremely low rate per ton. That is all right; but tar is not of the same value in all districts. At the price it now commands in some areas, it might be looked upon by the electricity industry as rather an expensive fuel.

The exquisite terpsichorean performances from time to time of our electrical contemporaries over the efficiencies of metallic filament lamps and their Methuselahian lives, have had the brake put upon them by a letter from Mr. F. W. Willcox. This unbelieving unit of the electricity industry writes to say there have been no published comparative lamp tests of the various makes of metallic filament lamps made thus far in England which have been of any value; such comparative tests as have been made having been "insufficient, incomplete, and inconclusive." The number of lamps tested is entirely too small to give any true indication of the average quality of the lamps; and the life tests have not been conducted on the proper basis. Such tests as have been conducted have been at rated voltage, which results in some lamps being started at one efficiency and others at other efficiencies. The results have been published just as they have come out, without any corrections for differences in efficiency, all of which leaves the life and candle power results incomparable. A true life and candle power test of lamps requires that all lamps should be started at the same average initial efficiency, or at least that the results obtained be corrected to bring them to a basis of equal initial efficiencies. This point, says the critical Mr. Willcox, is totally neglected in tests so far conducted, giving inconclusive results and very misleading information. It is really too bad of Mr. Willcox giving away even a single point in the game. We remember what Mr. Gaster said last year, before the Committee on Misrepresentation in Trade, as to the misstatements in the markings of electric lamps.

Not long since one of our electrical contemporaries published some information from "Food and Cookery" on the superiority of electric cooking over gas cooking. But, with excellent care, there was omission in our electrical contemporary of the simple fact that the article had been "communicated." Bearing upon the recent tests that have been published in the "JOURNAL," it is understood that the editor of "Food and Cookery" has now made a simple private test with a gas and electricity heated oven, the results of which are of considerable practical interest as showing that so far gas holds its own. Two joints of beef, weighing exactly 4 lb. 12 oz. each, were taken and placed, the one in a gas-oven and the other in an electric-oven. Twenty minutes were allowed for the heating of both ovens. For the gas-oven 1 hr. 35 min. was allowed for cooking, and 2 hrs. for the electric-oven. When equally cooked, the joints were taken out of the ovens and found to weigh respectively: I. (gas), 3 lb. 9½ oz.; II. (electricity), 3 lb. 3 oz. In the case of the gas-cooked joint, there was 13½ oz. of dripping and gravy, and in that of the other 19 oz. When the joints were cold, they were again weighed; the results being: I., 3 lb. 7½ oz.; II., 3 lb. The meat cooked in the gas-oven had thus lost 2 oz. in cooling, while that cooked by electricity had lost a further 3 oz. The cost worked out at ⅜d. for the gas-oven, at 2s. 6d. per 1000 cubic feet, and 2½d. for the electric-oven at 1d. per unit. Thus on all points—time, weight, and cost—gas scored. But these tests do not give such good results as others that have recently been published by us from tests carried out by well-known cookery experts.

INTERNAL COMBUSTION ENGINES AND GAS PRODUCERS.*

THIS subject is one in which authors have been somewhat prolific during the past few years, though for the most part the publications have treated of engines and producers of foreign manufacture. The work under review is partly a translation, and partly an adaptation of the authors' book on the same subject published in Swedish in 1909. It may at once be said that for the majority of readers it is neither too long nor too short. It contains much that is of interest, a good deal that is original, and omits a great deal of matter usually, but not necessarily, included. In this connection, it is positively refreshing to read a book in which the usual historical survey is omitted. In most works of this sort, it has been necessary to wade through very similar accounts of the evolution of the gas-engine from its earliest days. We must therefore be thankful that "want of space made it necessary" for the authors of the one under notice to omit going over the same ground as many others.

The work contains 303 pages of well-written matter, adequately illustrated, and suitably arranged in two parts. Part I. treats of the fuels mostly employed in gas and oil engines, and the various types of producers in general use. As usual, the fuel (town gas) most generally employed—in this country, at any rate—is passed over with scant consideration. That this is so is quite incomprehensible to those who know to what a very large extent town gas is used for fuel in gas-engines. It is the fuel *par excellence*; and gas engineers know full well how many suction-gas plants have had to give way to ordinary coal gas as fuel in many large towns, such as Birmingham, where gas is supplied at a low price—say, 1s. 6d. per 1000 cubic feet, or thereabouts. This portion of the volume constitutes about one-third of the whole, and fairly covers the ground.

Part II. commences with an introduction in which the author [Mr. Askling is the author of Part II.] predicts great developments for the internal combustion engine in the direction of ship propulsion. No one can gainsay the fact that an engine utilizing up to 36 per cent. of the energy of the fuel should have little difficulty in replacing steam-engines using no more than 15 per cent. The author deals in a manner which indicates considerable practical experience with the constructional details of the various parts of the engine. Practical considerations alone are discussed; and for 90 per cent. of readers of such works, nothing further is required. Ignition systems of many types are very fully described. Starting arrangements, details of inlet and exhaust piping, silencers, and the cooling of the cylinders are well treated.

Quite a feature of the work is a full account of the various types of reversible engines. Much good work has been devoted to the perfecting of arrangements by means of which the internal combustion engine could be made to compete with the steam-engine for marine purposes. The author shows the success with which these efforts have been attended.

Not the least useful part of the book is that in which many practical hints are given of the various "disturbances in the working" of gas-engines, the symptoms which indicate what is wrong, and the remedies to be applied. Details of the operating cost of a suction-gas plant are given, from which it is seen that fuel expenses amount to 33 per cent. of the total cost per horse power per hour; the remaining cost being composed of interest and depreciation, attendance, maintenance, insurance, oil, and waste, &c. It is further shown that the guaranteed consumption of anthracite is taken at 0·97 lb. per horse power per hour, which is increased to 1·39 lbs. in every-day working, owing to the additional fuel required for heating the producer during the cessation of working and on starting, and to the engine running below its maximum power. It is in some such details as these that the engine running on town gas can show economies.

The authors have done their work well; and the book calls for little criticism of an adverse nature. It is, however, to be hoped that future writers on this subject will not omit to mention what an important part town gas plays as a fuel for the gas-engine in this country.

* "Internal Combustion Engines and Gas-Producers." By C. W. Askling and E. Roester. London: Charles Griffin and Co. [12s. 6d. net.]

North of England Gas Managers' Association.—We learn from the Hon. Secretary and Treasurer of this Association (Mr. Herbert Lees, of Hexham) that the next meeting will be held at Newcastle-on-Tyne on Saturday, the 4th prox. As already mentioned in the "JOURNAL," items of the programme will be a paper to be submitted by Mr. R. Nelson, of the East Hull Gas-Works, and a lecture on "Light and Competition" to be delivered by Mr. Jacques Abady.

AN IDEAL GAS DISPLAY AT THE IDEAL HOME EXHIBITION.

[*Photos. by the Tella Camera Company.*]

THE SOUTH METROPOLITAN GAS COMPANY'S STAND AT THE IDEAL HOME EXHIBITION—FRONT VIEW.

A FEW paces from the "Daily Mail" Ideal House at the Ideal Home Exhibition at Olympia, and in one of the main avenues, is a stand that has been placed there with a set and definable purpose. It is a true work of art; and an example of the purest refinement. Its intention is to show that for lighting and heating—in fact, that for all operations in which light and heat are required—gas can form an integral part of the most artistically designed home, with the most refined appointments, and at the same time give a household a maximum of convenience and comfort. Running the eye generally over the stand, the first impression of one accustomed to gas displays is that never such a stand has been seen at an exhibition—either at home or abroad—erected for the express purpose of enlightening the public on the point that refinement of taste and the application of gas as part of a general scheme of decoration and utility are not incompatibles. Going critically over the stand, from the structure itself, through its furnishing, to the gas-fittings, for lighting and heating, a defect in workmanship, in finish, in harmony cannot be discovered. It is an exquisite setting to the display of gas lighting and heating; and the lighting and heating by gas add to the charm of the whole. Pictorial illustration does not do the picture that is presented to the eye the justice that it merits. Colour, brightness, cleanliness have all a vitalizing power in the formation of impressions. But in the photograph, the harmonizing refinement of detail and of colour is lost, as well as those little details that make for perfection. The credit for the conception, design, choice of detail, and the fitting work that combine to demonstrate the artistic fitness and the convenience of gas in the ideal home are all due to the South Metropolitan Gas Company, who have undertaken the demonstration single-handed. We congratulate the Company upon the work; and all who have had voice or part in the production of this proof—proof that will appeal to the most dilettante—of the perfect unison between gas and the most refined home.

The work has not been carried out without one serious obstacle; and it was an obstacle of a class that had to be negotiated by diplomacy. It so happens that Olympia is situated in the area of the Hammersmith Borough Council; and the Borough Council are purveyors of electricity in their area. With the authorities of Olympia the Council have an agreement, which gives them the right to the supply of current for the illumination of stands at exhibitions held in this place. There was a little disposition at first to set this agreement up in opposition to the South Metropolitan Gas Company carrying out their educative project at the Ideal Home Exhibition; but—possibly because the Council were disinclined to face the public charge and odium of playing the part of "dog in the manger"—their right was waived. It was just as well that it was, as in any case the stand would have been there; and the Borough Council might not have been favourably impressed by its alternative disclosures.

THE STAND AND ITS APPOINTMENTS.

However, it will have been gathered that the stand must be seen to be properly appreciated; but for those who will not have an opportunity of visiting Olympia by or before April 30, a description will convey interest. The structure occupies a space measuring 40 ft. by 20 ft.; and it is divided into three apartments, the front one being (shall we call it?) a reception room, and the two rear ones are fitted with kitchen and bath-room

appliances. The arrangement gives the whole picture at a glance; and it cannot fail to arrest attention. To arrest attention is, of course, one object; and that object will be met by this stand with an individuality of its own as exhibition stands go, and with a striking superiority to anything among its surroundings. Attention arrested, the second object is gained—the demonstration of gas lighting and heating refinement in the midst of all else that is like in artistic character. We want this object, which is the capital one, to be borne well in mind in reading this description. The captious may be disposed to say that kitchen and bathroom ceilings have not, as a rule, ornate mouldings, or that the floor of a kitchen is not commonly constructed of mosaic work. That is agreed; but the idea is to prove that, no matter the lengths to which ornate structure and appointments are carried, gas can be applied not only as a suitable adjunct, but as an actual contributor, to the artistic scheme. To accomplish demonstration nothing has been spared.

The general scheme of the structure is seen in the photograph. In the main apartment, the exposed part of the flooring is of parquet work. A sharp triangular shaped piece supplies an artistic foreground, on which are flowers, chairs, and sunk mats. From the floor rise square pillars, the ornate bases of which are of polished walnut, the upper parts white enamelled, and with ornamental capitals. Between the front pillars and the entrances is a boldly curved front and counter made of polished walnut. Here inquiries are answered. The pillars carry the roof, around which is a deep frame work (with ornamental decoration at the bottom), forming on all sides a facia, filled in with cream-green glass, with gold relief, and lettered in ruby crystal. The wording on the front is "South Metropolitan Gas Company;" on both sides are the words "The Ideal Light for the Ideal Home;" and at the back the words "Light, Heat, and Power." This facia is illuminated by concealed "C" burners with Chappuis reflectors; and at night-time, it is an extremely pretty and live facia. Externally on each side of the stand project half-a-dozen gas-brackets of quite a new design—designed, in fact, at Old Kent Road. These have large back plates. The top horizontal tube of the bracket carries a depending ornamental piece attached top and bottom to the back plate. The down tube supplying the burner is made straight. The "Metro." No. 2 burner is concealed. From the down tube three chains connect to the upper part of the supporting frame for a Holophane basin-shaped globe; and the bottom is finished with a brass ornament. This fitting is worth special attention. It is a strong and equal competitor with the artistic designs in fittings and under-shades which have been produced by the force exercised by the glare of the metallic filament electric lamp—the glare making it imperative that the defect shall be counteracted by external means. The larger area of the incandescent mantle than of the metallic filaments of an electric lamp, with the Holophane globes, give a soft and well-diffused light.

THE KITCHEN EQUIPMENT AT THE STAND OF THE SOUTH METROPOLITAN GAS COMPANY.

Inside the Principal Apartment.

We now pass inside the main apartment. It seems almost an offence to walk about it with the dust of the exhibition paths on one's feet. Bordered by the parquet work we have a sunk floor, in which is laid a Rose du Barry coloured carpet—specially made for the stand. The shades on the gas-fittings, it is observed, match the delicately rose-tinted carpet. The effect tells the observer of a keen artistic perception in whoever filled in the details of this display. Forming a bordering between the parquet flooring and the carpet, we have a stamped, bright gun metal edging; which makes the delicate carpet look as though set in a metal frame.

At the back of the room are the fire-place and overmantel. The mantel is of polished walnut; the mirrors at the top are deeply bevelled. The fire-place is handsome. Sides, back, and hearth are lined with "Lustre" tiles; and the curb is of marble. It is all very handsome. The fire which has the honour of place in this desirable setting is externally of art-coloured lustrous enamel; and it is supplied with "Metro." or "Standardized" fuel. This fuel will be a novelty to those who have not previously seen it. It is very durable and tough; and it is different from all other gas-fire fuel. It is not in column form; but vertical lines of it are built up, as desired, by small pieces tapering from front to back and of square section—the larger and open square of each piece being in front, the smaller part at the back. The visual effect is that as one—standing or sitting—looks at the fire, one seems to be looking into a depth of incandescent fuel, for every part of the structure of each piece of the fuel is incandescent and visible. The heating effect is excellent—the structure being such that there is no check by the front of the fuel to the radiant heat from its back. It will be remembered that not long since in our columns Mr. Charles Carpenter was supporting Mr. J. Ferguson Bell's view that the fuel of gas-fires should be standardized; and then it was learned that the South Metropolitan Company had designed and standardized a fuel that could be applied to almost any gas-fire. Here it is in these little basket-like pieces of fuel. It has several good points; its bad ones have yet to be discovered. In this, we, at all events, have to the present failed. The gas-fire is fitted with a side-stand tap, which is such a convenience to the user.

Beautiful furniture stands about the apartment—inviting and pleasing. There are the gas-fittings—all oxidized silver, chaste in design (mostly after the Adam style), for one, two, or three lights, and fitted by either the "Metro." No. 1 or No. 2 burners, surrounded by white crystal globes. Those in authority at the South Metropolitan Company have a *penchant* for white crystal glass globes slightly frosted with decoration, and not tinted ones. Where colour is desired, it is considered preferable, and much more artistic, to obtain it by means of pretty shades.

Here is a chance for making a close acquaintance with the "Metro." burner, and its novel parts—the means by which the tarnishing of metal parts is avoided, the details of construction—the bayonet joint by which the whole burner can be detached from its fitting in a second, the same method (or rather the lines of the same method) by which the globe is supported, and inquiry can be instituted regarding the fixed regulation of the gas and air supplies, which removes from the hands of the consumers any need for any adjustment other than that by the tap. We were a little curious as to the behaviour of the burner in a district in the gas supply of which a goodly proportion of carburetted water gas is at the present time, owing to the coal strike, to be found. There had been daily experience of the burners in their native district with a straight coal gas, the constitution of which, as far as can be judged by the use of the gas for several purposes, appears to be as invariable as it can well be. The "Metro." burner in a private house, run on straight coal gas, has been a pleasant and gratifying experience. But at Olympia the proposition was altogether different, with a large percentage of water gas in the mixture; hence the little curiosity as to what would be

THE BATH-ROOM EQUIPMENT AT THE STAND OF THE SOUTH METROPOLITAN GAS COMPANY.

[In this photograph there is a good illustration of the side Bracket Lights on the Stand, fitted with Holophane Basin-shaped Globes.]

the behaviour of the burner, nippled for the gas, but with fixed regulation. Suffice it to say, though the burner is being used under trying conditions, the lights were doing excellently. They would not have been there had there been any misgivings as to their ability to meet the conditions.

There is another point that strikes one in the display. No pipes are visible. No cappings for pipes spoil the symmetry of the structural work. Gas-fitting lends itself to good work, as well as to bad work. We look at the white ceilings. There is no attempt to give gas the slightest advantage. The ceilings are snow white, relieved in all parts with neat ornamentation mouldings after the Adam style. A small detail perhaps, but one that cannot escape a man looking about for points to praise or criticize, is the neat manner that the gas-fittings fit into the ornamentation of the ceiling. Ceiling ornamentation and gas-fitting can with care have a consonance equal to that necessary between the parts of a piece of mechanism. We have it demonstrated here. On the standards round the apartment, there are bracket lights; and at the base of the standards further convenience is demonstrated. Flush and unobservable until pointed out are little trap-doors. Open one of these; and there is provided the connection for a standard light or reading lamp. There are handsome standard lamps about the room. It is all well done.

There is one other point of novelty that attracts attention. Depending from one of the pendants is a connecting-piece with tap, to which is fixed a piece of flexible green covered tube, not of much larger diameter than a telephone wire. At the other end of the flexible tube is a press-button-controlled bye-pass jet burning in a small cup. Press the button, and a longer and stronger jet is at once supplied for lighting the burners of the pendants or for lighting cigar or cigarette. On the pendant itself is found a small hook into which the active part of the bye-pass device is hung, thus keeping it out of the way, and allowing the miniature jet to burn upwards in its shielding cup. It is always ready; always handy. It dispenses with a separate bye-pass to each burner, if a consumer has any objection to matches or tapers, or does not care for the systems of switch-lighting that are now on the market.

Among the Kitchen Appliances.

Passing into the apartment devoted to kitchen appliances, here again everything is artistic, and the fittings of the best. The real mosaic floor, the imitation marble and tiled walls with green relief, the moulded ceiling—all attract notice. There is a tiled recess for the "Metro." gas-cooker, and alongside it a Potterton hot-water circulator is at work. Hot and cold water are supplied over a sink of a bold design and serviceable capacity. A table in the middle of the room displays the "Metro." gas-iron, in which, with a consumption of 2¼ cubic feet per hour, perfect combustion is obtained. This apartment is illuminated by a three-light pendant and bracket, switch controlled, as are also the lights in the adjoining bath-room.

In the Bath-Room.

Entering this apartment, the same lines of decoration are found. The room is fitted with a porcelain bath supplied with hot water from the circulator in the kitchen, or from a Fletcher geyser. A lavatory basin and a clothes-airer are likewise supplied with hot water from the circulator. A Fletcher two-tube flueless radiator is the means of heating for the bath-room.

The partition between the three apartments forms a chamber for the flues from the heating arrangements; and there, too, the gas-supply pipes and controlling cocks are all assembled.

The Object Accomplished.

The stand is a success in accomplishing the object it was intended by the South Metropolitan Gas Company that it should serve—proving to all that gas can be applied for lighting and heating in the ideal home, so as to subscribe to, and not detract from, artistic merit, while diminishing labour, and offering the maximum of convenience, efficiency, and economy. These form a group of virtues that are each and all worth advertising, and worth advertising well. This the South Metropolitan Company are doing at Olympia—true, away from their own district, but at a place and exhibition that will be patronized by many of the residents in their district, and the residents in the areas of many other gas undertakings near and far afield.

Some Other Exhibits.

Wright's "Calefactor."

Messrs. John Wright and Co. are exhibiting at Olympia; and at their stand close acquaintance may be made with the "Calefactor." This is their latest gas-heated hot-water apparatus for the economical supply of domestic and other requirements—baths, lavatory basins, sinks, &c., and also for the feeding of hot-water pipes and radiators for heating purposes. The new apparatus can be attached to any existing system of hot-water piping to work with the householder's own storage tank. The connections are quite simple. The "Calefactor" may be connected with the range boiler, so that either or both may be used as desired. The various forms of the apparatus, and the various ways of employing it, are shown at the stand. The apparatus is made of cast iron, and is very compact. Any extra capacity required beyond one can be obtained by forming a battery of two or more—simply placing them one upon the other, or alongside each other. The boiler part is all in one casting, which includes a three-chambered pre-heater. Apart from the flow-and-return connections, and the cleaning arrangement, there are no joints whatever. In the "Calefactor," the combined boiler and pre-heater is constructed on the counter-current principle; and the pre-heater, in addition to increasing the efficiency of the apparatus, considerably reduces the gas consumption. The accessibility of cleaning was demonstrated to us. The front of the casing is removable by loosening four milled-head brass screws, and then everything is open to the hand and eye from the front; and a brush does the work perfectly. The combined boiler and pre-heater being enclosed in a lagged cast-iron outer casing, the heat is conserved. Of course, the "Calefactor" has to be connected up, by the usual circulating-pipes to a storage tank or cylinder.

The apparatus is supplied with a bunsen burner, or with a thermostat and white-flame burner. In the former type, there is a sequence of three bunsen burners, controlled in series by three successive positions of one tap. The first and smallest burner of the sequence consumes the minimum of gas required to maintain the temperature of the water, once the entire sequence has heated up the installation. The two larger burners can be used together, or only one as required. A luminous burner is fitted to the type of "Calefactor" having a thermostat, as being more economical

for continuous work, where the apparatus is merely maintaining the temperature of the storage water ready for immediate use, a duty which requires most—usually three-fourths—of its time. During all these hours the thermostat cuts down the consumption of gas to a very small figure indeed. Only for a short period after each occasion when hot water is drawn is the gas turned on full by the thermostat, to heat the cold water. This work consumes gas at rates not in excess of 40 cubic feet per hour for size B2000, and 80 cubic feet per hour for size B2002, and this only for the occasional short periods. An exposed burner of the luminous flame type with thermostat and the necessary appliances are at the stand to demonstrate the efficient working of the combination. In the case of the type with bunsen flame and without thermostat, the three sections of the burner, used together, consume up to, but not exceeding, 40 cubic feet per hour for B2000 size, and 80 cubic feet per hour for size B2002. When the water is heated up, the two larger sections can be shut off; leaving the smaller burner, consuming up to 10 cubic feet per hour, to maintain the temperature. Usually, the cost of heating for a warm bath is well under 1d.; but, of course, this depends upon the price of the gas. As to time, the average rate of heating to bath temperature with B2000 is approximately 1 gallon per minute; and with B2002, nearly 2 gallons per minute. For a higher temperature for dish washing, with B2000, the delivery is about ⅓ gallon per minute; and with B2002, ⅔ gallon per minute.

The stand at the exhibition at which interesting investigation can be made into these various matters is lighted by the "Nico" inverted incandescent gas-burners.

R. & A. Main's Exhibit.

Close by, we have a stand tenanted by Messrs. R. & A. Main, Limited, who have staged samples of some—space imposes a limit—of their choice productions. The stand (which is lighted by Sugg low-pressure high-power lamps, with smaller ones of another make round) displays goods that assist in making an ideal home. The central features of the stand are the "St. Nicholas" and "Santa Claus" (we think this was the name given to us by the genial attendant) gas-fires, set back to back; and leading into a single dwarf flue, which one is invited to investigate by the olfactory method to ascertain how complete is the combustion. The public stop to look at the front fire, for the deception that "St. Nicholas" practises of looking like a cheerful coal fire while the incandescence is sustained by gas-burners, is a matter for popular inquiry at the stand, with the result that the correctness of the use of "Saint" in the title is questioned. In the ideal home, the simple but artistic "D.S.O." gas-fires, with their varied coloured enamelled surfaces, will fit in with any decorative scheme. On the stand can be found gas-heated labour-saving appliances and conveniences of all descriptions—fires and radiators, cookers, grillers, hot-plates, baking-plates, boiling-rings, and water-heaters.

Potterton's Specialities.

Those who were not able to examine, at the recent Smoke Abatement Exhibition, the new "Sealed-Oven" gas-cooker that Mr. Thomas Potterton has designed, can do so at the Ideal Home Exhibition; for it is on a stand close by that of the South Metropolitan Gas Company. A special article in the "Journal" recently described this cooker, and its virtues. Among the other exhibits, are seen the "Queen" combined kitchener and separate gas-heated hot-water apparatus; and this demonstrates the utility of gas in supplying hot water for general uses. One can do as one pleases with the "Queen" kitchener, to the extent of using it as a coal-burning fire or a gas-heated cooking appliance. Several of the exhibits are at work. The "Victor" gas-boilers and accessories press themselves on notice. There are various forms of this popular gas water-heater to be seen here, including the complete automatic gas-heated hot-water supply apparatus.

The Foster Gas-Governor.

Facing one side of the South Metropolitan Gas Company's stand, the Foster Engineering Company are exhibiting their special form of gas-governor for the purpose of equalizing pressures in the house. We need not emphasize here the importance of pressure regulation for maintaining concordant efficiencies with gas-consuming appliances. At the stand, the governor can be examined. Its compact form will be admired; and the rapidity with which it can be fixed will also be obvious. Its effective operation is likewise demonstrated. The governor is of the mercurial type, and is adjusted by movable weights. Two valves act together to control the pressure; and to the dual valvular arrangement is attributed the sensitiveness of the device.

Ewart's Water-Heaters.

Messrs. Ewart and Son are forward with a selection of their "Lightning" gas-geysers, as well as the "Califont" water-heater. The stand is fitted up with baths, &c., to demonstrate the efficacy of the apparatus. It is shown how hot water can be obtained for a bath at any time by means of gas at a cost of under ¾d. A "Califont" is shown equal to 10 gallons of hot water per minute, which is enough to make our electric friends very envious, as they reckon time in bulk water heating by the day, and not the minute.

Miscellaneous.

At the stand of Messrs. Wilmer and Sons, the Premier tarless (smokeless) fuel is seen; grates supplied with the fuel being in use. Air-gas plants are shown by Messrs. Tredegar and Co., the British and Colonial Lighting Company, Limited, Messrs. Strode and Co., and County Light, Limited. Messrs. Stott and Co. are also showing their mercurial gas-governors.

"DIRECT" SULPHATE OF AMMONIA MAKING.

CAN THE PROCESS BE ADOPTED ON GAS-WORKS?

By Arthur Douglas, B.Sc.

The recent granting of a patent to Mr. Radcliffe for a direct sulphate of ammonia process [see "Journal" for Jan. 30, p. 276] has reawakened interest in this country in the question of direct ammonia recovery as applied to gas-works.

Practically every direct process of sulphate manufacture which is worth anything is of foreign origin—principally German. The best known, perhaps, are those of Koppers and Otto; and both these are well established on coke-oven plants in this country. It is encouraging to note the advent of Mr. Radcliffe's process, as showing that our English chemists are not entirely neglecting this particular field of development, and also to note that this new process overcomes difficulties met with or suggested in both the Koppers and the Otto processes. Koppers originally said that it was impossible to remove all the tar without cooling the gas; and hence he works at a temperature of about 40° C. This, of course, necessitates the condensation of liquor, and consequent distillation. The Otto process involves no cooling of the gas. It works at about 100° C.; and hence no liquor at all is formed before all the ammonia is recovered direct in the saturator. In Radcliffe's process, the saturator works at a temperature of about 250° C.; so that there is absolutely no condensation of liquor, and hence no distillation. At no point prior to entering the saturator must the gas be cooled down, else condensation would occur. Consequently, the gas has to be scrubbed, and the tar extracted, at a temperature considerably above 100° C. To the writer it would appear a somewhat difficult matter to deal with a large bulk of gas—say, 2 million cubic feet per day—and maintain it at this high temperature without entailing a great amount of expense.

It is interesting to note, too, in connection with this process how theories of tar removal, sulphatation, &c., have changed in a very short time. Not many years ago Messrs. Clayton and Skirrow, in a paper read before the Manchester District Institution of Gas Engineers,* gave a series of results of experiments on the removal of tar-fog from gas. They seemed to show conclusively that even with the best apparatus, in order to eliminate completely all tar, it was necessary to cool the gas to atmospheric temperature. Against this we have a graduated development. In the Koppers process, cooling to about 25° to 40° C. is necessitated; while in the Otto process, by the use of a special form of tar-spray, the gas is not allowed to go below 100° C. In both these processes, the tar is effectually dealt with, as is shown by the good, white colour of the sulphate obtained. Lastly, we come to the Radcliffe process, where the tar is eliminated at a temperature of from 150° to 250° C. As yet, however, no details of the working of this process are obtainable; and it remains to be seen if it can be worked with as much satisfaction as other processes are giving.

The question which is bound to come to the front during the next few years is the possibility of adapting any of these direct-recovery processes on gas-works. Much has been written recently as to the use of coke-oven gas for town purposes; and in places where such gas is used, the ammonia is recovered by direct processes. It is interesting, therefore, to consider these processes from the standpoint of the gas engineer contemplating the adoption of one of them. What are the principal features to be considered? In what details is the process likely to necessitate a change in the usual gas-works practice? And, lastly (and one might add the most important), Is the purification from ammonia satisfactory and is the quality of the gas affected?

With regard to effect on gas-works practice, almost the only thing would be a saving in labour and plant. No scrubbing or scrubbing water is required. Carbonization can proceed in exactly the same way, and pressures and temperatures need little alteration. Indeed, Dr. A. Fürth, of Leipzig, has shown that the pressures on a coke-oven plant working on the Koppers process corresponded almost exactly with those existing on gas-works.

The most important detail coming under this heading is that of purification requirements. Ammoniacal liquor plays a considerable part in the purification of the gas from sulphuretted hydrogen, carbon dioxide, cyanogen, &c. If the direct process is adopted on gas-works, this purification power of ammonia will have to be allowed for; and it will make some marked difference on the capacity of the rest of the purifying plant. There will be all the additional sulphuretted hydrogen to be dealt with; and this will necessitate larger purifying area. Then, too, carbon dioxide will in all probability have to be considered, as the quantity will be increased to such an extent as to produce a marked effect on the quality of the gas. This will mean introducting lime purifiers.

Many and various opinions have been expressed with regard to the quality of the gas after the ammonia has been removed by the direct process. On the one hand, we are told that the gas is deteriorated by the passage through the sulphuric acid; while on the other we are told that it is unaffected. As this is a most important point in connection with the application of the process to gas-works, the writer has made many inquiries from persons in a position to judge, and has also himself made several experiments. The chief consideration is the effect of the acid bath on those saturated hydrocarbons which are so valuable in coal gas as both

* See "Journal" for June 4, 1907, p. 660.

heat and light producers—viz., benzene, ethylene, acetylene, &c. Are these absorbed by the sulphuric acid to such an extent as to appreciably affect either the calorific value or the illuminating power? The writer concludes that the determining factors are (*a*) strength of acid in saturator, and (*b*) temperature in saturator—the former being the predominating one.

This is arrived at after a series of tests made in the following way: Unpurified gas was used from a point after the condensers, and led through a T-tube, and so divided into two streams. One stream was led direct to a calorimeter, and the calorific value determined. The other was led through a bath of sulphuric acid of known strength, to remove the ammonia, and then the calorific value of this gas was determined in another calorimeter. Samples of gas from both sections were also taken and analyzed. It was found that approximately 50 per cent. of free sulphuric acid must be present before either the composition or the calorific value was materially affected. With a higher temperature, the effect on the gas was noticeable with rather less acid; but the results here obtained were not quite satisfactory. The writer is making a further series of experiments on the above lines, and hopes to communicate the results at a later date. When it is remembered that in the direct processes not more than 5 or 6 per cent. of free acid is present, it will be seen that there is not likely to be much action on the gas. Indeed, all coke-oven managers the writer has heard of who have made any tests in this respect, fail to notice any effect at all on the gas. Further, owing to efficient separation, no free acid is carried forward by the gas from the saturator.

On the whole then, the question of the adaptability of the direct process seems to be only a question of someone coming forward who is bold enough to take the initiative and instal it. The extra cost of purification for sulphuretted hydrogen and carbon dioxide would be more than covered by the saving in other directions—in scrubbing plant, &c. What is wanted is a really continuous process whereby the sulphuretted hydrogen in the gas can be utilized to provide the sulphur necessary to form sulphate of ammonia—an idea worked out in the Burkheiser process, but which, however, does not seem to have met with very much success.

STEEL OR CONCRETE FOR GASHOLDER TANKS.

The subject of the relative suitability of structural steel and concrete for use in building large gasholder tanks was discussed by Mr. Herbert W. Alrich, of the Consolidated Gas Company of New York, in a paper submitted by him to the eighth annual meeting of the National Association of Cement Users; and the following epitome of the communication appeared recently in "Engineering Record."

The controlling requirements in the design of a gasholder are structural stability, economy, rapidity of construction, and durability. Certain features governing the distribution of gas require the locating of the holder on the lowest available ground. In America, such sites are frequently on reclaimed ground; and this greatly increases the difficulties of building a concrete structure, which of necessity must be below the surface. In England, such tanks have been built by lining a cylindrical excavation in the clay with brick walls; the brick in some cases having been made from the excavated clay. In America, the length of time required for such construction, together with the lack of suitable geological conditions, has prevented its use. It can be readily seen, from its relation to the guide-framing, that the construction of such a holder out of concrete above the ground would be impossible. The writer participated in the design and construction of the three largest concrete holder tanks in the world, two of which are 300 feet in diameter by 48 ft. 3 in. deep, while the third is 189 feet in diameter and 41 ft. 6 in. deep—all inside dimensions. The work on these three tanks proceeded in such simultaneous relation as permitted any improvement in methods developed on one to be employed to advantage on another.

At the time the tanks were being designed, Mr. W. H. Bradley, the Chief Engineer of the Consolidated Gas Company, made a thorough inquiry as to the design of any other concrete tanks that had been constructed anywhere in the world; and there was found little precedent to consider. As regards the two 300 feet tanks, the undertaking was one of unusual magnitude, for the holders were the largest ever built. The possibilities of nickel steel were not at the time fully understood; hence the construction of steel tanks would have been unthinkable, as there would have been required plates 4 inches thick, connected by 3-inch rivets. It was therefore evident that masonry construction of some kind must be employed. A number of different designs were worked out, analyzed, and compared, resulting in the conclusion that the most advantageous construction would be a plain annular wall of reinforced concrete; and all three tanks were thus built. The work upon them was accomplished with entire success. The smallest required a full year for its construction. An entire holder of the same size having a steel tank can, it is stated, be constructed in seven months without special effort. In the opinion of the writer, in no case where a steel tank is at all possible will the cost reach 70 per cent. of the outlay required for a corresponding concrete construction.

The question of the relative durability of steel and concrete can only be determined by the test of time; and at present there are not available data sufficient to make a just comparison. It is noted, however, that blasting in the vicinity of brick tanks has frequently damaged them to a considerable extent; and concrete structures would be subject to the same danger. The variation in the quality of concrete and the difficulty of repairing such a structure are likewise factors to be considered.

An external examination of a large number of steel tanks, some of which had been in service for more than twenty years, showed the metal in surprisingly good condition, though the quality used in their construction was decidedly inferior to that employed at the present time. An internal examination of some of the oldest steel tanks in existence indicated that, except at the water-line, there was no perceptible deterioration. In one case, the holder had been employed for twelve years in connection with a process of gas manufacture now obsolete. As a part of the process, a non-luminous gas containing some sulphur was stored in the holder, which resulted in the sulphur being absorbed by the water in the tank. The interior of the tank was found to be only very slightly pitted.

In summing up, the writer stated as his conviction that, while not possessing one single element of advantage over steel tanks, concrete tanks are subject to the following comparative disadvantages: (1) Increased cost, generally 75 per cent.; (2) longer period required for construction, generally 100 per cent. for the entire holder; (3) liability to impairment from unforeseen or unavoidable causes—such as internal stresses, bad water, oil or alkaline soil, and blasting; (4) difficulty of making repairs and obtaining the original strength in case of rupture; (5) possibility of corrosion or reinforcement—the vital element of the tank's strength; (6) inaccessibility of metal to inspection; (7) greater load on foundations; (8) requires the most rigid inspection and supervision to control the quality of the work during construction; (9) liability to serious difficulties from storms during construction, due to the depth of excavation, the necessity for maintaining adjacent streets, requiring sheet piling 50 feet deep and massive shoring timbers. Also liability of damage to the concrete work itself from the same cause.

The author enumerated the distinct advantages of steel tanks when compared with those of masonry, as follows: Less cost; shorter period required for construction; the ease with which the quality of the work may be controlled during construction; the high state of development in fabrication and erection; susceptibility to exact computation and greater reliability under stress; accessibility for inspection; tank may be placed at any desired elevation in relation to the ground line; no liability to damage by storm during construction; no serious internal stresses from shrinkage or temperature; possibility of rectifying an unequal settlement; no liability to cracking from undetermined causes; ease of making repairs and obtaining the original strength.

By way of emphasizing the economy of time in building a steel tank due to the efficiency of the method of fabrication and erection, Mr. Alrich closed his paper with a description of the methods employed in building a large steel tank.

Bavarian Association of Gas and Water Engineers.

The programme for the twenty-seventh annual general meeting of this Association, which is to be held at Aschaffenburg from the 26th to the 28th inst., is as follows: Proceedings open with a reception on the evening of the 26th; and on the morning of the next day papers will be read of which the more noticeable are: "The Importance to Gas-Works of the Central Heating Problem," by Herr Ohly, of Cologne; "Pyrochemical Apparatus and Works Methods," by Dr. Schumann, of Munich; "The Present Position of Street Lighting by High-Power Lamps, relatively to other Modes of Lighting, with Methods of Lighting and Extinguishing," by Herr Himmel, of Tubingen; "Advances in Gas Lighting," by Herr Petsch," of Berlin; "The Siemens Pneumatic Lighting and Extinguishing Apparatus for Street-Lamps, and the Heating of Churches by Gas," by Herr Hertel, of Dresden; "A New Method of Heating Gasholders," by Herr Geiger, of Nuremberg; and "A New Charging and Discharging Machine for Horizontal Retorts," by Herr Eitle, of Stuttgart. The Corporation gas, water, and electricity works will be visited in the afternoon and described by Herr Schmiedt, the Manager. A banquet will be held in the evening; and the last day of the meeting will be devoted to an excursion.

Scottish Junior Gas Association (Western District).—According to the sessional arrangements, the annual meeting of the Western District Division of this Association was to have been held last Saturday; but it had to be postponed till the 20th inst., owing to the irregularity of the railway service consequent upon the miners' strike. An interesting feature of the meeting will be an address by Mr. Alex. Wilson.

Gas Sampling Apparatus.—A description by Mr. F. S. Sinnatt, of a convenient apparatus for obtaining an average sample of gas, and for regulating the flow of a gas into an evacuated vessel, was to have been given at the last meeting of the Society of Public Analysts and Other Analytical Chemists, held at the Chemical Society's Rooms, Burlington House; but, owing to the absence of the author and the time occupied by the reading and discussion of other papers, Mr. Sinnatt's communication was taken as read, and will be published in due course.

PRACTICAL HINTS ON THE MANAGEMENT OF PRODUCER SETTINGS.

By Dr. R. Geipert, of Berlin.

A contribution to recent numbers of the "Journal für Gasbeleuchtung" on this subject by Dr. R. Geipert, of the Berlin staff of the Imperial Continental Gas Association, opens with the observation that, while technical literature abounds in theoretical disquisitions on producer retort-settings, comparatively little has appeared written from the practical standpoint, and a good deal of that which has been so written presents contradictory views. For these reasons Dr. Geipert considers that some notes on the working of producer settings should be helpful to students, and of interest to practical gas men. The following is an abstract translation of Dr. Geipert's communication.

Coke, which is the fuel used for producers on gas-works, consists chiefly of carbon and ash. On combustion, the carbon is burned by the air, and the ash remains as clinker in the furnace. Only the oxygen, which represents about 20 volumes per cent. of the air, participates in the combustion of the carbon; and the nitrogen, of which the residual 80 volumes consist, passes unchanged into the products of combustion or flue gases. Oxygen combines with carbon to form its own volume of carbonic acid; and if the oxygen were completely utilized in this way, the flue gases would consist of about 20 volumes of carbonic acid and about 80 volumes of nitrogen. This would be a case of combustion with the amount of air theoretically necessary, and consequently with the most favourable development of heat. If, however, more air is supplied to the fuel, as is practically essential, the excess of air connotes a loss of heat, because the heat required for heating the surplus air is rendered useless for the heating process.

Producer settings afford special advantages where high temperatures of great uniformity are required. The fuel is first converted to a combustible gas—producer gas—which is taken to the place where combustion is required. A producer setting consists of: (1) The gas-producer; (2) the setting or furnace in which the heating gas is consumed; and (3) the regenerator which utilizes the heat of the hot flue gases.

The Producer.

A combustible gas is produced from coke and air in the producer by the conversion of the carbonic acid by means of incandescent coke into combustible carbonic oxide. The conditions for this conversion must exist in the producer, which is a vertical chamber of refractory material having a grate at the bottom on which at least 40 inches of incandescent coke rests when the producer is in action. The air, streaming through the coke, in the first instance forms with it carbonic acid, which, on passing through the upper layers of coke, is converted into combustible carbonic oxide. The conversion is the more thorough the higher the temperature of the producer and the longer the carbonic acid and the coke are in contact. It is of the greatest importance that the carbonic acid should have sufficient time to react with the incandescent fuel.

The blue flame observed on the top of the bed of fuel in stoves, boiler furnaces, &c., is due to the local formation and recombustion of carbonic oxide. It is not, however, practically possible to convert the whole of the carbonic acid into carbonic oxide; but the quantity of carbonic acid unconverted depends on the construction and operation of the producer. The cross section and height of the producer must be such that the gases do not pass through it at more than a certain velocity, and a sufficiently deep and highly incandescent layer of coke must always be maintained. Granted that the construction of the producer fulfils these conditions, frequent and regular charging of the producer is an essential condition of its operation. Moreover, the accumulation of clinker must be avoided by the use of rods for pricking-up the fire. This pricking-up is unnecessary if a step-grate is used. With the ordinary grate, in addition to pricking-up, the producer has to be thoroughly cleaned at intervals by clinkering, for which purpose subsidiary fire-bars are inserted about 20 inches above the ordinary grate, and the clinker beneath them is cleared out. The frequency and duration of pricking-up and clinkering the producer depend on its method of construction and the coal or coke used. Pricking-up cannot be deferred after a deficiency in carbonic oxide occurs when the primary air-damper is fully open; and clinkering must be carried out as soon as clinker begins to accumulate above the level of the auxiliary fire-bars. More frequent pricking-up will, however, often be of advantage, and trial will show to what extent expenditure of wages thereon is justified.

Steam, produced in the pan beneath the grate, or blown in from a special boiler heated by the flue gases, is introduced through the grate with the primary air. It serves to keep the grate cool, and thereby to protect it from distortion and destruction, while preventing the formation of hard clinker. On passing through the incandescent coke, the steam reacts, with absorption of heat, to form combustible gas—viz., a mixture of carbonic oxide and hydrogen. A portion of the steam, however, passes through the producer undecomposed, and the proportion of undecomposed steam is greater the more steam is introduced. Since undecomposed steam injures the fire, as little steam as possible should be admitted. The high temperature of the producer gas as it leaves the producer is responsible for a considerable part of its heating value; and in order that this part may not be lost, the producer must either directly communicate with the place where the gas is to be consumed, as is shown in fig. 1, or be carried through gas-tight passages, which should be as short and well insulated as possible, to the place of combustion. Also the producer itself must obviously be sound in order that extraneous air may not gain admission. When the lid of the producer is opened for charging it with cold coke a flame should be applied on opening.

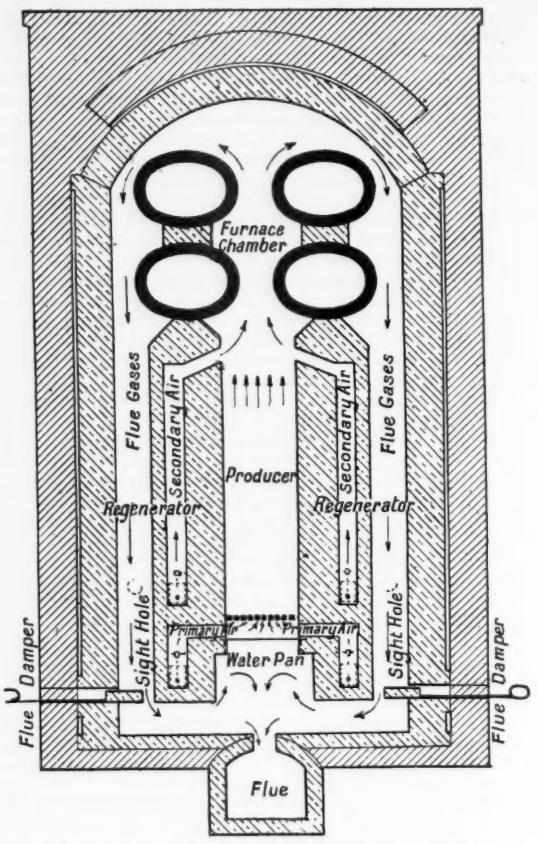


Fig. 1.—Cross Section of Producer and Retort-Setting.

The Setting.

The purpose for which the producer gas is used is immaterial for the present consideration. Correct distribution of the heat and of the carbonic oxide and air in the furnace or setting must be presupposed; but the construction of the setting may vary greatly in different cases. The producer gas enters the hot chamber of the furnace along with air, and being ignited there burns with great development of heat, thereby raising the temperature of the furnace and its contents. Experience must teach what is the most useful heat to be attained in any case; and it will be attained the more readily and economically the more uniform the working of the setting. When fluctuations in the output of the product have to be considered, the working has to be modified, as in the case when a portion of the plant is out of operation while another portion is doing its ordinary work. The settings, for instance, remaining in operation must receive the heat required to maintain their temperature constant. This uniform heating is secured through the manipulation of the primary and secondary air supplies. The primary air is that by which the producer gas is formed, and is introduced below the producer grate; while the secondary air is that which is introduced in the furnace-chamber for the combustion of the producer gas. The production of producer gas depends on the quantity of primary air introduced. The small variations in the amount of steam introduced have little practical effect on the mean temperature over a moderate period of time in the furnace chamber.

It would thus appear that all that would be necessary in order, to secure uniform heat would be to regulate the quantity of the primary air, and thereby the quantity of producer gas formed while burning the latter with the necessary amount of secondary air. This method, simple though it may appear, is not practicable, because the primary air, as well as the secondary air, is drawn in by reason of the draught of the chimney; and if this draught is uniform, the amount depends on the resistance of the producer, which varies continually according to the quantity and nature of the clinker and the size of the coke. Other measures must be adopted to secure uniformity of the primary air supply, and thereby of the formation of the producer gas. The quantity of secondary air introduced depends upon the resistance of the setting or furnace, which is practically constant. The amount of secondary air and producer gas may be readily correlated. Carbonic oxide burns with a blue flame, and advantage may be taken of this to observe, when air is added, if the flue gases contain carbonic oxide. The blue flame is most readily observed at a

low temperature, and therefore in the cool regenerative passages rather than in the highly-heated furnace space. Fig. 2 shows an opening of about half-an-inch diameter through which air passes to one of the passages of the regenerator; and the colour of the flue gases flowing through the passage is observed through the sight hole. If a blue colour appears, due to the combustion of the carbonic oxide in the flue gases by the air entering through the hole, the formation of producer gas is checked by

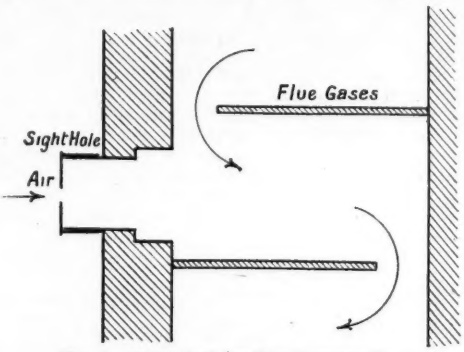


Fig. 2.—Sight-Hole for Flue Gases in Generator.

throttling the primary air until the blue colour disappears. Even traces of carbonic oxide produce this colour; and any considerable excess of carbonic oxide can thus be readily avoided. The loss due to carbonic oxide may be very considerable—for instance, if the flue gas contains 18 per cent. of carbonic acid and 3 per cent. of carbonic oxide, the latter implies a waste of 14 per cent. of the fuel.

On the other hand, there may be a deficiency of primary air, and therefore of producer gas, if the flue gases remain colourless when air is admitted to them. In this case the primary-air damper is opened to increase the supply of producer gas. By throttling or opening the primary-air damper, it is thus possible to equalize the effects of variations in the resistance in the producer, and in this way to form flue gas which contains constantly from 18 to 20 per cent. of carbonic acid. With a constant secondary-air supply the quantity of producer gas is thus kept constant, and the heat developed in the furnace is maintained uniform. Uniform development of heat may not, however, always be wanted. In retort-settings the heat required must vary, for instance, according to the wetness of the coal and the weight of the charge. In such cases the draught must be slightly altered in order to accommodate the heat supply to the heat consumption, and so maintain the temperature of the setting unaffected by the condition or quantity of the charge.

It is obvious that the heat in otherwise constant conditions will be affected by unsoundness or obstructions in the setting; and careful observation must be kept in order that any such evils may be rectified directly they arise. The question of the secondary air and the draught with which a setting should be worked in ordinary conditions is an important one. The same development of heat may be secured by opening very wide the secondary-air damper and keeping the draught low, or by curtailing the secondary-air opening and increasing the draught. But practically the draught must not be unduly reduced, because sufficient suction on the producer must be maintained in order to overcome the resistance of the clinker and the small coke and secure the normal admission of primary air. On the other hand, the draught must not be excessive, in order that the effect of unsound places in the setting may be as small as possible. The relation of the secondary-air opening to the flue draught must be determined by trial for the particular type of setting when it is first brought into action. It is ascertained by trial how far the secondary-air damper must be opened for the combustion of the quantity of producer gas formed, when the primary-air damper is half closed, and pricking-up of the producer is not required too frequently. The draught is then varied until the desired temperature is obtained in the setting.

The following simple rules for the ordinary uniform supply of heat to the setting may be deduced from the foregoing considerations—viz: The secondary-air opening must remain unchanged; the primary-air supply is to be frequently reset in order to afford the proper combustion of the flue gases; and the draught, measured shortly before the flue damper in the regenerator, is to be kept constant and often checked by observation.

The Regenerator.

The considerable amount of heat possessed by the flue gases when they leave the chamber of the setting is utilized by transference to the primary and secondary air. The transference is effected in the regenerator, which, in its simplest form, consists of two adjacent passages, through one of which the flue gases pass to the chimney, while the other conveys the air for combustion in the opposite direction to the furnace. The air thus takes up heat from the flue gases to an extent depending on the efficiency of the regenerator, which is determined solely by its construction, provided it is sound.

If unsoundness occurs above the sight-hole already referred to (see fig. 2), and the correct composition of the flue gases is shown at the sight-hole, it will result in a portion of the producer gas being burnt in the regenerator, which will therefore be heated in place of the furnace. The unsound regenerator will have an extremely high temperature compared with another setting of like construction in which the regenerator is sound. If, on the other hand, the unsoundness is below the sight-hole, the flue gases are merely cooled and the efficiency of the regeneration is reduced. As this is a smaller evil than the former, it follows that it is advisable to have the sight-hole as high in the regenerator as is possible consistent with convenience and precision of observation of the flue gases. The exact location of the unsound places, if they occur in the partition between the flue gas and air passages, is best traced by making analyses of the gas at different parts of the regenerator. A less tedious method of locating the unsoundness depends on the fact that producer gas burns with a blue flame. If, therefore, the flue gas contains a good deal of producer gas, it will, if air is introduced at any spot, burn there with a blue flame. In order to utilize this property as a test, an excess of carbonic oxide is produced in the flue gases by throttling the secondary-air opening. A blue flame, which can be seen through a glass disc inserted on the part of the flue where unsoundness of the flue-gas passage is suspected, will be seen where the cracks occur.

If the unsoundess occurs in a part of the regenerator where the gas is already so much cooled that it does not ignite directly, another opening must be left clear through which a flame, started with a torch, extends into the passage. This precaution prevents the occurrence of an explosion when the quantity of carbonic oxide is increased. On closing the opening at which the flame was started, the only flame remaining is that produced by the air passing through the cracks. There is, of course, in this procedure some risk of an explosion if the flue gases, containing a good deal of carbonic oxide, on their way from the place of observation to the chimney, mix with air, with which they form an explosive mixture at a lower temperature. If this risk is ever feared, gas analysis must be resorted to. Serious unsoundness may also be detected by comparative measurements of the diminution of draught in the regenerator. These measurements also are used for the detection of stoppages in the regenerative passages or in the furnace itself. If a sound regenerator is abnormally hot, even though the flue gases have the right composition, the cause is generally faulty mixing or incorrect distribution of the air and producer gas in the furnace chamber. Some of the air and gas then pass into the regenerator and develop considerable heat there. This late combustion may be avoided by altering the distribution of the gas in the furnace-chamber. Occasionally, producer gas passes directly into the regenerative passages through unsound places in the walls of the producer.

Starting the Settings.

The settings must be brought into action by stages. In order to raise the cold setting quite gradually to its proper working temperature, time must be allowed for the heat to become uniformly distributed in the setting. Part of the setting must not be highly heated while another part is comparatively cold; otherwise cracks, &c., will arise. Experience with the particular type of setting must determine how quickly it may be heated up. Generally, with new settings three weeks are required in lighting up. The fire is then increased for a week; and two or three days further are allowed for transition to normal working. Settings which have already been in action may be heated up more quickly.

The lighting-up or drying-off of new settings is effected by putting a layer of coke, in height not exceeding the width of two hands, on the grate of the producer. This coke is introduced through the clinkering door. With this shallow bed of fuel, producer gas will not be formed; but air is admitted over the layer of coke (through the holes intended for the auxiliary fire bars) in order to avoid any risk of an explosive mixture being formed which might be fired subsequently. If the chimney also is new, it is dried-off and warmed by a fire started on a temporary grate at its foot. The draught used in drying-off the setting should be kept uniform. The air supply is for the time being controlled by the primary-air damper. Careful supervision is requisite. It is advantageous at first to cover the greater part of the grate with slabs, so that only a small portion of it is covered by the hot coke. In the second week some of the slabs are removed, and in the third week the whole of the grate is freed and covered with coke. At the mouth of the furnace chamber the temperature should then be a dull red heat. It would be difficult to increase it further with the shallow bed of fuel; and, consequently, at this stage the method of heating is changed.

For the purpose of getting-up the heat in the setting which has been dried-off in the manner described, producer gas is formed and burned in the producer as well as in the setting. The layer of coke on the grate is increased in depth so gradually that flame is constantly present on the top of the coke; the air supply for the combustion of the producer gas being maintained through the openings provided for the temporary grate bars. It is an advantage to throw the coke on to one side of the fire. After the coke has reached the level of these openings, they are closed, and a special opening is made at the back of the producer opposite the outlet for the producer gas. An ample supply of air is introduced through this opening to burn the gas; and the bed of fuel is then increased in depth until it is about 9 inches below the outlet for the gas. The latter must be kept clear in all circumstances. The combustion is regulated by means of the primary air so that the

formation of producer gas is at the outset kept low, in order to avoid the setting being too strongly heated. The supply of primary air is gradually increased as the setting gets hotter. The draught need not be altered. After a week of this treatment, the furnace chamber where the combustible gases enter should be at a bright red heat, which should gradually diminish towards the outlet. The transition to ordinary working is then made by opening the secondary air damper to the extent to which it is judged it will be opened in ordinary working, and closing the primary air damper to an extent which will prevent the producer gas being in excess of the secondary air supply. The air-inlet in the back of the producer is then bricked-up, and the producer filled with coke. The heating of the setting then proceeds, and the regulation of the dampers and draught for ordinary working is effected. So long as the regenerative passages are cold, an excess of producer gas should be avoided. Any cracks which develop in the outer walls of the bench are filled up.

Letting-down the Setting.

When it is necessary to let down the setting for repairs, or on account of faulty action, it must be allowed to cool very gradually; otherwise the masonry will suffer. In many cases it suffices to put the setting on "slow fire," which implies a sufficient temperature for the combustion of the producer gas by the secondary air; but otherwise only sufficient to cover the loss of heat by radiation. As this loss, however, varies in different cases, careful consideration must be given to the question of whether the expenditure of fuel in keeping the setting on "slow fire" may not more than balance any disadvantages accruing from letting out the fires entirely. It should, however, be borne in mind that with a properly-insulated setting the fuel consumed when it is on slow fire is small; that the setting suffers little or no injury; and that normal heats may be regained within one to two days. For bringing a setting to slow fire, the primary air damper is almost completely closed, and its position then exactly regulated so that just sufficient producer gas is made to keep the setting hot enough. This procedure assumes that it is not necessary for any other reason to alter the secondary air supply or the draught. When it is necessary to let-down the setting, it is first put on slow fire, as already described; and the coke in the producer is gradually used up in the course of a few days. The heat of the setting will then have fallen to redness. The producer is next rapidly drawn, all dampers are closed, and all openings except that of the sight-hole in the flue-gas passage are sealed with fire-clay. The setting is then left to cool slowly by radiation; the sight-hole serving for the admission of air to prevent a vacuum within the setting. The retorts should be scurfed before the setting is let down, the valves on the gas and tar take-off pipes closed, and the caps of the ascension pipes opened.

Measurement of the Temperature.

Temperatures up to about 1300° Fahr. may be measured by means of mercury thermometers, which for the higher temperatures are charged with nitrogen or carbonic acid under pressure, and are made of special refractory glass. For temperatures above 1300° Fahr., electrical and optical methods must be employed. The choice of method must depend on whether it is a flame or a heated surface of which the temperature is required. For flame temperatures up to 2900° Fahr., the Le Chatelier thermo-electric pyrometer, consisting of a junction of a platinum and a platinum-rhodium wire, with a galvanometer by which the change in the resistance of the junction depending on the change of its temperature is observed, is the best instrument. Generally, however, it is more important to know the temperature of the heated surfaces; and this is commonly roughly estimated by the eye. But even great experience will not serve to prevent uncertainty in estimations of temperature made in this manner. Consequently they must be checked by frequent observations with an optical pyrometer. The Wanner pyrometer, of this type, has a matt-surfaced disc having constant illumination, with which the brightness of the surface under observation is compared. It is suitable for giving rapid and exact measurements of temperatures above 1150° Fahr. The Seger cones, which are three-sided pyramids of mixtures having different melting points and distinguished by numbers, are specially useful for safeguarding the material of the setting, &c., against overheating. They should be renewed, in any event, once in fourteen days. Since the cones must be exposed for a little time to the necessary temperature before they fuse, temperature measurements made with them generally do not come out so high as when the pyrometer is used.

Measurement of the Draught.

The chimney draught is the negative pressure subsisting at the foot of the chimney, and the furnace draught is that in the regenerator just before the flue damper. The furnace draught, *cæteris paribus*, determines the heat which is applied to the setting. For controlling working, the draught clearly must always be observed at the same point, since it varies at different parts of the setting. The form of gauge used for measuring the draught varies according to whether it is a fixture or portable, and the degree of precision to which it is required to work. Since the draught in the furnace or setting does not ordinarily exceed 4-10ths of an inch of water, it is clear that the observation of fluctuations must be made with considerable care. The ordinary U-tube, filled with water, is the commonest gauge; but as readings cannot be made with it with great precision, modifications in which one limb is widened and the other limb is inclined, have been introduced. Also benzol, alcohol, or other liquid is used in place of water, and a correction applied for the difference in specific gravity. Another form of gauge is one devised by Seger, and improved by Rabe. It consists of two wide cylinders connected below by a narrow U-tube, and filled with two liquids of different densities, with their point of contact in the narrow tube. The cylinder containing the heavier liquid is in communication with the gas of which the pressure is required; and the fluctuations of level of the liquid are multiplied several times in the fluctuations of level of the lighter liquid in the other limb of the narrow tube. The instrument needs some care in charging and setting-up. Another draught indicator is that of Hudler, which consists of a metal plate, which rises and falls as the draught increases and decreases, suspended in a metal casing which it fits loosely. It is connected with the flue by a short length of wide pipe. It needs careful standardization, but has the advantage of being readily portable and not easily damaged by shock or blow. Fluctuations of draught in the main flue due to atmospheric influences should be overcome by the use of a readily adjustable damper at the foot of the chimney.

Gas Analysis.

The author describes the Orsat apparatus for the determination of carbonic acid, oxygen, and carbonic oxide in flue gases, &c., by absorption. He points out that an analysis of producer gas throws light on the operation of the producer and the soundness of the gas exit, while an analysis of the flue gas shows whether the ratio of air to gas is correct, and whether there are leakages or stoppages in the setting or regenerator. Since, however, analyses occupy some little time, they must generally be resorted to only as a check on the observations and control carried out by the methods referred to in preceding sections, and to clear up points which these leave in doubt.

HYDROCARBON RESIDUES FOR GAS MAKING.

A patent has been taken out for France by MM. Clauzel, Fournier, and Vindrier, for a process for the manufacture of gas suitable for lighting, heating, and motive power by conveying tar, schist, oils, or hydrocarbon residues into the hydraulic main, or treating them separately. The following particulars of the process are translated from the French specification.

Superheated steam, in sufficient quantity to carry forward the material selected and act as an oxidizing agent, is injected into the hydraulic main of a retort-setting, or into a tank containing tars, schists, &c., resulting from previous distillations. The mixture is subjected to a number of successive treatments with the view of distilling the entrained tar, and eliminating the principal portion of the carbonic oxide and carbonic acid. In these subsequent treatments, the known properties of certain metals, such as nickel, iron, &c., are utilized; and they transform, by catalysis, the carbonic oxide into methane. This action is necessary for the patentees' process; but it is only one of the means which, combined with others, contribute to the final result. The invention, therefore, differs essentially from the known methods for the manufacture of water gas subsequently altered in character by the catalytic action of red-hot iron to make it applicable for lighting and heating.

The gaseous mixture obtained by the process described passes through a layer of incandescent coke, red-hot iron, a second layer of coke, and, if necessary, another layer of iron. It is advantageous to convey it through incandescent coke before subjecting it to the catalytic action of iron, because the various hydrocarbons of the aromatic series are very slightly reduced, as also the cyanogen and nitrogen compounds. On the other hand, the steam which acts as the vehicle and agent in oxidizing the tar, schist, &c., which it holds in suspension, and the gasification of which is thus commenced, is decomposed by contact with the coke, and hydrogen, carbonic oxide, and carbonic acid are produced; whereas the nitrogen left in the coke is set free, and fixes the greater part of the sulphur contained in the coal, as also a small portion of the carbon, with formation of cyanogen.

The gaseous mass passes through the red-hot iron, which acts as a real catalyzer, like the nickel utilized by MM. Sabatier and Senderens, as described in the "Comptes Rendus." Some of the hydrocarbons are separated one from the other in a more volatile form. The nitrogen, ammonia, and cyanogen remain in about the same proportions. Finally, the carbonic oxide absorbs part of the free hydrogen to form methane, with liberation of carbonic acid and gaseous hydrogen. Owing to the presence of steam, no carbon is deposited on the iron, and oxidation of the metal is delayed; and it can consequently be employed until complete oxidation takes place. After passing through the red-hot iron, the mixture is conveyed again through incandescent coke, which transforms most of the remaining carbonic acid into carbonic oxide; and finally there is produced a gas suitable for the same purposes as ordinary coal gas. Its proportion of carbonic oxide can, if required, be further decreased by passing it over another layer of red-hot iron; but in practice this appears to be superfluous. The gas is washed and purified in the usual way before being sent out for consumption.

LONDON AND SOUTHERN JUNIOR ASSOCIATION.

Visit to the Works of the Mitcham and Wimbledon Gas Company.

Between forty and fifty members of the Association availed themselves of the invitation to visit the works of the Mitcham and Wimbledon District Gas Company at Mitcham on Saturday afternoon.

On arriving at the works, the party were conducted to No. 1 retort-house, where great interest was displayed in the working of the charging-machines and ram discharger. They were then formed into groups, and conducted over the works; the guides being Mr. B. R. Green (General Manager and Secretary), Mr. W. T. Hogg (Chief Assistant), Mr. S. J. Oxer (Draughtsman), Mr. E. Clother, Mr. J. Smith (Foremen), and Mr. N. Broadbridge (Junior Assistant). Under their guidance, the tour of inspection proved most interesting and instructive. In view of the visit, the following description of the works had been prepared by Mr. Green.

In some notes which were prepared in advance for the information of the members, it was stated that the districts supplied by the Company include Wimbledon, Merton, Mitcham, Tooting Graveney, part of Streatham, and part of Carshalton. The output of gas in 1911 was 816,381,000 cubic feet, and the manufacturing capacity about 4,250,000 cubic feet per day.

No. 1 retort-house is provided with two gas-engine driven coal-handling plants, each capable of breaking and elevating 30 tons of coal per hour into four overhead storage hoppers of a total capacity of 200 tons. There are seventeen settings, each of eight horizontal retorts, 20 feet long, oval Ω section, 22 in. by 16 in. There are two scoop-charging machines, and one telescopic ram discharger operated by compressed air. The charges are 9½ cwt., and are worked off in eight hours. A chain conveyor, driven by a gas-engine, discharges the coke into 1 ton skips, which are lifted by a crane travelling on an overhead gantry. No. 2 retort-house contains four settings of six and four settings of eight retorts, 20 feet long and 22 in. by 15 in.

The gas passes through retort-house governors, and then through two annular air-cooled condensers (worked in parallel) and two water-cooled reversible condensers (in series) to the exhausters, which are driven by "Farey" compound condensing steam-engines. In the exhauster-room there are two air-compressors for charging up the air-receiver in No. 1 retort-house, and also eight "Oddesse" patent duplex steam-pumps, for pumping water, tar, liquor, and boiler-feed. Above this room are the drawing office, the laboratory and photometer-room. Overhead tanks are placed on top of the building, for storing 60,000 gallons of water and liquor. The gas next passes through the tar-washer, naphthalene-washer, and rotary scrubber, to oxide purifiers—four 30 feet square boxes, of Milbourne's type, and two 30 feet square catch-boxes. After leaving the station-meter, the gas passes to a 36-inch diameter inlet cylinder, and from thence to the four storage holders, which have a total capacity of 2,900,000 cubic feet. The outlets of the holders are connected to the outlet cylinder. This leads to the distributing cylinder, which is the common inlet to three district governors, 16-inch, 18-inch, and 24-inch respectively. An automatic bye-pass governor is fixed between the inlet and distributing cylinders. A turbine-driven fan of 350,000 cubic feet per hour capacity is connected so as to pull the gas from the low-pressure holders, and push same into the distributing cylinder, so that a holder pressure (top lift) of 4 inches may be converted into 9 inches at the inlet of the governors. In the governor-room is fixed the recording apparatus, which shows on a daily chart the pressure of gas in the centre of the Wimbledon district, 2 miles away. The sulphate of ammonia plant is capable of producing 5 tons per day.

The carburetted water-gas plant (Cutler's type) consists of two sets of 600,000 cubic feet each, and one set of 800,000 cubic feet per day capacity, with washers, scrubbers, condensers, relief-holder, two exhausters, cyclone tar-extractor, six 20 feet square oxide purifiers, and a station-meter. There are two Sturtevant fans, belt-driven from Tangye high-speed compound steam-engines, and one direct-coupled turbine fan. The coke is elevated to the stage-floor by a hydraulic lift. After leaving the station-meter, the carburetted water gas passes to the inlet cylinder in the governor-room, where it mixes with the coal gas and passes to the holders.

The carburetted water-gas tar is sent to the coal-gas reversible condensers, in which it is sprayed under 70 inches pressure on to the tubes, washing off the naphthalene. There is a 27-ampere 100-volt electric generator for lighting the purifying sheds and the meter and governor room. The water supply is from an artesian well 375 feet deep, raised by a three-throw pump, driven by means of a gas-engine.

At the conclusion of the inspection, the party were entertained at tea by the Directors of the Company. After the repast,

The PRESIDENT (Mr. J. G. Clark, of the Gaslight and Coke Company), in calling upon Mr. S. A. Carpenter to move a resolution, said he was sure the members had all spent an enjoyable and instructive afternoon. There was so much to be seen on the works that the time had gone by all too quickly. He was particularly struck with the accurate recording of the temperatures in the carburetted water-gas superheaters by means of pyrometers, which must help greatly towards the efficient working of the plant. Other points which appealed to him were the workshops, which were not only well fitted up, but were quite a model so far as cleanliness and light were concerned. Then, again, the apparatus which Mr. Green was using for the control of the district pressure was a new step in the right direction, and was attaining the object sought by so many—viz., the maintenance of a constant pressure in the district, which was a point of great importance to all users and suppliers of gas.

Mr. S. A. CARPENTER (North Middlesex), in proposing a vote of thanks to the Directors of the Company for kindly throwing their works open to inspection, said that the members were particularly grateful to Mr. Green for being present, and to his assistants who had given up their afternoon and patiently taken parties round the works, answering all queries, and explaining points of interest. He remarked upon the fact that it was very creditable that gas could be sold so cheaply by the Company (2s. 8d. per 1000 cubic feet), considering that, though the works were perhaps situated in pleasant surroundings, all the coal had to be carted some distance; the nearest railway station being about half-a-mile away. In the reconstruction of the works which had been going on during the last few years, it was evident great care and thought had been exercised in the planning of all details and the provision for future extensions. The workshops in particular were model shops, and a great improvement on what one generally saw.

Mr. J. HEWETT (South Metropolitan Gas Company), seconding the proposition, remarked that, though the Mitcham works were somewhat inaccessible, he was quite sure he was voicing the opinion of all in saying that for the trouble of getting there they had been amply repaid. There was much of novelty on the works, and everything seemed to be quite up to date and in good working order; reflecting greatly on the capable administration of the undertaking.

Mr. D. S. WINSLOW (Lea Bridge), in supporting the vote, said the Association were much indebted to the Directors for allowing the members to visit the works, and in particular to Mr. Green and all those who had conducted the members round them. Cleanliness and efficiency seemed the keynote of the works; and the results obtained were indeed something to be proud of, and taught many lessons to those who had the privilege of living and working in such surroundings. He added that he would also like to thank the Directors very much indeed for their hospitality, which was greatly appreciated.

Mr. C. TANNER (Gillingham) also supported the vote of thanks.

Mr. B. R. GREEN, in replying, said he was glad to hear that the members had spent not only an enjoyable, but also an instructive, afternoon. It had given him pleasure to be present, and do what he could towards their enjoyment, So far as the works were concerned, they could not really lay claim to much novelty, except, perhaps, in the method of regulating the district pressure. At the same time, novelty was attractive; and he had a desire, in all new work, to be up to date. This object he had kept well to the front in the remodelling of the works which had gone on during the past few years. He eulogized the excellent and efficient help he obtained from his assistants, which, he said, did much to ensure good all-round results; and those the Company obtained from their plant were most satisfactory, and enabled them to supply gas at so comparatively cheap a rate as that charged. The district was developing very rapidly; and this meant that all new buildings and plant should have ample provision for the future.

Mr. W. T. HOGG, speaking on behalf of those who had conducted the members round the works, said the pleasure had been mutual; and he was glad so much had been found of interest.

Brandenburg Association of Gas, Electricity, and Water Engineers.—The thirty-third annual general meeting of the Association was held in Berlin from the 13th to the 15th inst.; the programme including a visit on Saturday afternoon to the chief main-pipe store and pipe-testing plant at the No. IV. works of the Corporation of Berlin in the Danzigerstrasse, and a trip on Monday to the Fürstenwalde works of the firm of Julius Pintsch. The technical proceedings included "A Report on the Lighting, Heating, and Water Industries' Museum," by Herr Müller, the Director; "Long-Distance Gas Supplies and Vegetation," by Herr Albrecht, of Berlin; "The Working-Up of Gas Liquor," by Herr Hilgenstock, of Magdeburg; and "Records of the Baudouin Gas-Pressure and Water-Level Distance Indicator," by Herr Lux, of Ludwigshafen.

M. Grebel on the Relations between the Characteristics of Gas.—The current number of the "Journal de l'Eclairage au Gaz" opens with a long article by M. André Grebel on the so-called "relations" existing between the characteristics of gas. The author deals first with the variations which take place in the quality of gas during its distribution, and then proceeds to inquire whether there is any relation between the lighting power and the calorific power of gas—a subject which is examined at some length. This leads to a consideration of the question of the relation between the illuminating power of gas produced by incandescence and when it is burnt alone, and also its calorific power; and then some observations are offered on the calorific power of gas and its capacity for absorbing secondary air to support combustion. Briefly, the conclusion arrived at by M. Grebel is that there is not, and cannot be, any exact relation between these various powers of gas. He says that their values fluctuate within tolerably restricted limits for ordinary coal gases; but they are not subject to any other law than that governing mixtures,

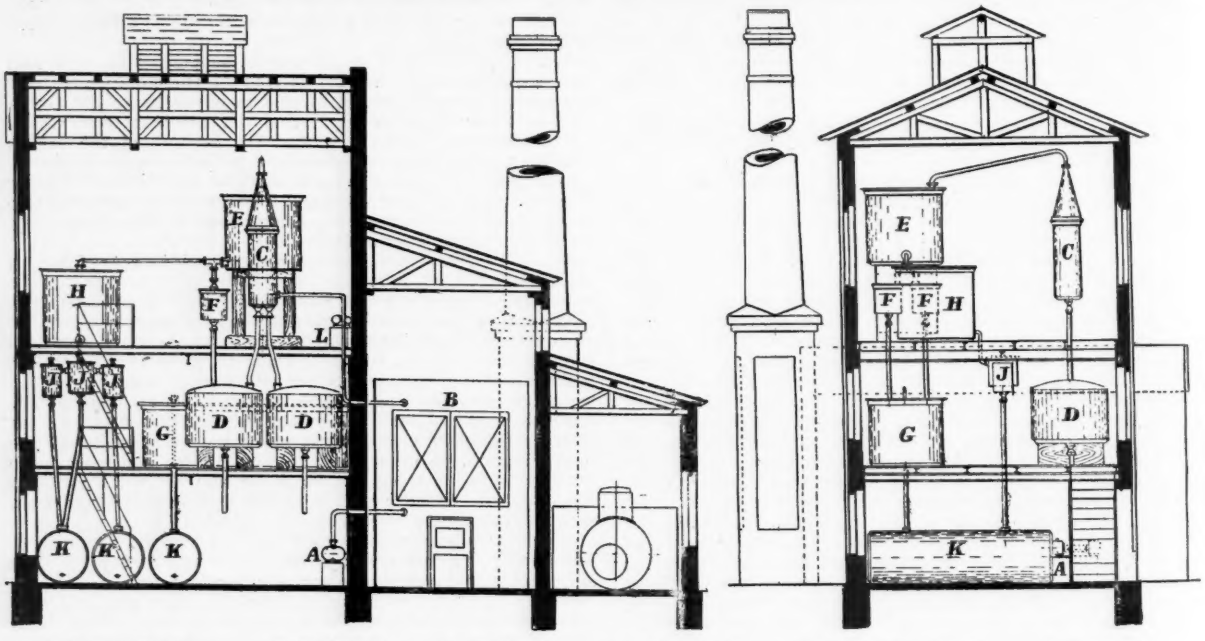
DISTILLATION OF TAR ON GAS-WORKS.

In connection with the use of tar oils for Diesel engines, Herr Albert Lemmer, of Berlin, has described, in a recent number of the "Journal für Gasbeleuchtung," a new process for the distillation of tar and petroleum residues for the production of oil of a grade suitable for use in such engines. The use of crude tar as fuel for Diesel engines, which has from time to time been suggested, he regards as being far from a *fait accompli*.

The process described is for the continuous distillation of tar or petroleum residues, with the object of obtaining therefrom tar oils and sott or hard pitch, and, obviously, is applicable to the working-up of tar mainly for the production of freed tar and soft pitch for use in road construction equally as much as for the primary production of tar oils for fuel purposes. The distillation plant may be heated by fresh fuel or by the exhaust gases from boilers or Diesel engines. The prime cost of production of one ton of tar oils by the process is stated to be about 15s. 3d. with direct firing, and 10s. 8d. when waste heat is utilized to avoid the direct expenditure on fuel. The author considers the process is specially applicable in gas-works under the same management as electricity or water works in which Diesel engines are used for power purposes. When crude tar is worth 23s. a ton, the cost for one effective horse-power-hour would amount to from 0·9d. to 0·11d. The fire risk associated with previous processes for the distillation of crude tar is avoided by the new process. The faults of the old process, in which stills or boilers are used, are numerous and are generally recognized.

The continuous process referred to has been patented in Germany by the firm of Victor Sadewasser and Co., of Berlin. It aims at avoiding the difficulties of dehydrating tar in stills where the heating of a mixture of water and volatile oils causes a highly explosive boiling-up of the contents of the still. It also avoids the intermittent cooling of the still for the purpose of running off the residual pitch. The crude tar is forced under high pressure in a continuous stream through a system of tubes which are heated either by direct firing or by spent flue gases. The liquid runs from the heater in a finely-divided atomized condition into a vacuous vessel, in which, owing to the great reduction of pressure on it as it issues from the spraying nozzles, it undergoes rapid volatilization. The vapours are then fractionally condensed. The conjunction of high pumping pressure, sudden reduction of the pressure, and atomization serves to effect very rapid gasification of the tar. The tar may, by continuous distillation, be broken up into as many fractions as are desired; the number of fractions depending on the number of vessels and their temperatures. When tar oils for use in Diesel engines are being produced, the residue in the flash still consists of a soft or hard pitch (according to the temperature used); and there are obtained also by fractional condensation, ammoniacal liquor, benzol, light, middle, and heavy oils. The proper construction of the tar-heater and the flash still are, however, very important for the successful working of the process.

The plant for carrying out the process is here shown. The particular plant illustrated is intended to deal with a ton of crude



A. Compressing Pump. B. Tar Heater. C. Flash Still. D. Pitch Receiver. E. Heavy Oil Condenser. F. Heavy Oil Receiver. G. Heavy Oil Tank. H. Light Oil Condenser. J. Light Oil Receiver. K. Tanks. L. Air Pump.

TAR DISTILLING PLANT FOR CONTINUOUS WORKING—GERMAN PATENT, No. 238,013.

tar per hour. The tar-pump A forces the tar continuously under a pressure of 15 to 20 atmospheres through the system of tubes of the heater B. The system consists of weldless tubes of 2-inch bore joined by screw socket bends, which are outside the heating chamber, the tubes in which are heated either by direct firing or by flue gases. These bends are easily detachable; so that a tube which becomes injured can readily and quickly be replaced. The length of the system of tubes depends on the quantity of tar and the temperature to which it is to be heated. The tar passes from the heater to the flash still C, which is under reduced pressure, and into which the tar issues through an adjustable atomizer. By reducing the outlet orifice, the pressure at which the tar stands in the tubes of the heater can be easily varied at will. Rapid evaporation takes place directly the atomized tar enters the semi-vacuous chamber of the still. The mixture of steam and oil vapours passes into the heavy oil condenser E, and thence through the train of condensers, which fractionally condense the rest of the oil vapours. The separation of water from the light oil is effected by the light-oil receivers J attached to the light-oil condenser H. The use of narrow tubes in the heater effects great economy of heat, the transference of which through the thin walls of the tubes occurs rapidly and completely. As the working is continuous, there are no losses through cooling-off the charges; and the preliminary heating, which is requisite in intermittently working plant, is thus saved.

It is evident that the high pressure to which the tar is subjected in the system of tubes prevents its gasification therein. Bubbles of gas do not form in the tubes, and there is no deposition of coke therein, because the tubes are constantly flushed by fresh tar under high pressure. Even after prolonged use the interior of the tubes remains quite clean and smooth. The life of the apparatus is thus far greater than that of the older types of apparatus. Risk of fire is avoided, because the vaporization of the tar and the condensation of the products take place in vessels from which air is excluded. Should one of the tubes start leaking, only a small quantity of tar passes through it, and is consumed in the furnace, whence the products pass up the chimney. The fall of pressure gives immediate indication of any considerable leakiness, and brings into play an automatic safety device by which the tar-pump is put out of action. Insurance against fire risks should be obtainable at lower premiums than with the old type of stills.

A plant of the type and of the capacity described has been in continuous use for 1½ years at a tar-works in Schleswig, and has given rise to no appreciable difficulties in its working. The experience gained indicates that the only delicate part of the plant is the tar superheater, some of the bends in the first portion of which, where they were exposed to the highest temperature, have burnt through. This fault has been overcome by protecting the bends in question by means of a screen half-a-brick thick. The Schleswig plant is heated by the flue gases from a Lancashire boiler having a heating surface of 860 square feet. The tar superheater is placed in the uptake flue of the boiler. The temperature of 680° to 750° Fahr. requisite for the production of hard pitch is not attained; and this plant has therefore been restricted to the production of heavy tar and soft pitch at temperatures from 520° to 640° Fahr. The construction admits of a damaged tube being replaced in twenty minutes at the longest. Such renewals have hitherto only been required in the first quarter of the system

of tubes. The heavy tar or soft pitch is deposited in the flash-still, and collects in a receiver below it.

Eight to ten tons of tar are dealt with in this plant in ten hours, with the labour of two men. In another plant, which is about to be brought into use, the tar superheater is heated by direct firing; and it is estimated that the coal consumption for the purpose will not exceed 2½ per cent. by weight of the tar dealt with. The capacity of the plant depends primarily on the capacity of the pump and the length and the diameter of the heating tubes. The plant, owing to the small space which it occupies, is very convenient for vaporization of effluent liquors from chemical works, as well as for the working-up of tar and petroleum residues.

SUBMERGED GAS-MAINS AT NEW HAVEN (CONN.).

This subject was dealt with in a paper prepared and read by Mr. H. E. WHITE, the Superintendent of the Street Department of the New Haven (Conn.) Gas Company, at the last annual meeting of the New England Association of Gas Engineers. In the course of it, he furnished the following particulars:

A study of the conditions as they existed in 1909 relative to the demand for gas in a rapidly developing portion of the territory of the New Haven Gas Company showed the necessity of a larger supply at an early date; and it was decided to run a reinforcing main from the Company's manufacturing plant, located on the west side of Mill River, to East Haven and Morris Cove. The most direct route involved laying a pipe under the river named, and also the Quinnipiac River. To those closely connected with the work, it was decidedly interesting, in more ways than one. There were numerous obstacles to be overcome, and some of our troubles are noted in the present description, in order that others contemplating a similar piece of work may have some idea of what possibly awaits them.

From our preliminary studies, we concluded that we would make no allowance for contraction and expansion on the horizontal line of pipe in either river. The length of line in Mill River would be approximately 325 feet, and that in the Quinnipiac River 700 feet. While no tests were made, it is doubtful if the change in temperature of the mud in the bottom of the river would vary more than 15° Fahr. per annum. This would cause a variation of approximately ⅜ inch in Mill River and ¾ inch in the Quinnipiac. As the ends of the horizontal pipe would be free to move, we saw no reason for installing a flexible joint.

The very important question as to whether flanged or bell-and-spigot pipe would be used and the joining of the pipes was then taken up. This was considered carefully, and it was decided to use bell-and-spigot pipe, to make-up on land a section consisting of several lengths, using cast lead for the joints. The size of pipe decided upon was 16 inches diameter. As serious results might follow if an accident should happen to a pipe while in use, it was decided to lay two pipes, and join them at either side of the river—placing gates on each line, and holding one line for emergency.

As the Company owned a fair-sized parcel of land on the east side of the Mill River where a landing was to be made, and not knowing to what use this piece of land might be put at some future time, the precaution was taken to lay two 6-inch pipes on the same foundation as the 16-inch mains—thus connecting the properties on each side of the river. Soundings were taken over the proposed line of pipe, and borings were made approximately 50 feet apart to determine the character of the river beds. At this point the river has a channel approximately 16 feet in depth. The bottom is formed of a layer of mud 10 feet deep, which rests on a layer of sand 5 feet deep. Rock underlies the bed of sand. The United States Government required the top of the main to be 20 feet below mean low water. A contract was let to lay two 16-inch and two 6-inch pipes on a pile and timber foundation; the piles to be sawn off at a given grade, and capped by 8 in. by 10 in. timbers. The stand-pipes at the east and west sides of the river were to be protected by cribs.

The work of dredging Mill River was readily accomplished. While the sides of the trench slid, there was not as much sliding or caving as was expected. There was no unusual incident connected with the driving and capping of the piles, which was done during the season of 1910. Unfortunately, the pipes were not laid until the spring of 1911; and by this time there was a depth of 4 feet of soft ooze on top of the caps. The borings did not show any rock to prevent the building of the crib and placing the drip on the west side of the river; but a projection was found that did interfere with placing the north end of the crib. This was built and securely fastened to an anchor by means of three 2-inch rods. The concrete was removed sufficiently to allow a 10-inch square timber 20-feet long, bearing against a number of piles. The three rods were run through this timber and the crib, and kept the latter from sliding. The entire area of the foundation was reconcreted. The drip and stand-pipe, consisting of two lengths of 16-inch pipe and one 16-inch pipe out of the horizontal opening of the drip, were made-up in one piece, and lowered into position. Six lengths of 16-inch pipe were lined-up on shore, and the joints cast and caulked. This 72-feet section was handled by suspending it from a girder built specially for the work. It was composed of two trusses, 60 feet long and 6 feet deep, spaced 12 inches apart. There were six panel points, or points of suspension. Each consisted of a plate on each truss placed opposite each other, with a hole in it large enough to take a 2-inch pin. This made a very easy and convenient method of attaching the chains to hold the pipe. The sections of pipe were lowered into position and held until divers had secured a uniform bearing on each pile-cap, by wooden wedges. The distance between the stand-pipes was 320 feet; and the line was laid in five sections.

The sections were all lowered in the same manner. A lead pipe ⅛ inch inside and ½ inch outside diameter was coiled from 12 to 15 turns on the spigot end of the section being lowered. When this was lined-up, and had a uniform bearing on the pile-caps, divers proceeded to force the lead pipe into the bell, and caulk each turn as it was entered. This ensured a joint caulked from the back to the face of the bell. After the joint was made, the bell was removed, and a section was cut out to be inspected. One of the reasons for using this joint was its simplicity.

After the line had been laid, it was flushed by pumping water into the easterly and removing it from the westerly end. The line was tested to 50 lbs. pressure of air; and it showed that there were small leaks at almost every joint made under water. The word "small" is used advisedly, for the water that accumulated in the drips in 24 hours amounted to only a few gallons. The joints were recaulked, stood the test, and one 16-inch line was put into use at once; and it has been in use since May 30, 1911. The horizontal pipes out of the top of the stand-pipe were connected to the land pipes by means of two Dresser insulating couplings. This is to protect us from electrolysis; and it also acts as a slip joint, and will allow for some slight movement of the pipes without causing damage.

In the case of the Quinnipiac, it was necessary to secure a tract of land on each side of the river. This was done by the purchase of a piece 50 feet wide on the west side, and a strip 30 feet wide on the east side. Only one line of 16-inch pipe was laid in this river. The United States Government required a depth of 16 feet at mean low water; and this necessitated removing a quantity of rock. The intention was to use pile and timber foundation for supporting the pipe, except where rock interfered. Two sets of piles were driven near the west shore, where there was about 5 feet of mud and sand to hold them in position; but two of the piles floated as soon as the hammer was removed, and the other two floated after a few hours. The idea therefore had to be given up. The mud and sand were washed away down to the rock, and concrete piers built; the concrete being deposited in sacks filled only about two-thirds full, to permit them to pack together.

The gas-main was laid in this river before it was put down in the other. A flexible joint was installed in the stand-pipe on the west side. On the first test of this line, when the gauge showed between 20 lbs. and 22 lbs. pressure, a number of air-bubbles appeared round the stand-pipe; and as they soon reached the proportions of a boiling cauldron, it looked as if something serious had happened under water. The test was stopped, and next morning arrangements were made to pump out the pipe. To our surprise, though sixteen hours had passed, only about 40 gallons of water were in the drip. A diver recaulked the joints on the stand-pipe, and the second test was started; when a similar result was experienced.

Suspicion rested on the flexible joint. Rough calculations were made, and it was found that a pressure of 22 lbs. per square inch on the 16-inch flange cover of the T-piece on top of the stand-pipe just about equalled the weight of the pipe; and when the internal pressure slightly exceeded this weight, there was sufficient play in the flexible joint to cause a leak. To put this assumption to the proof, a weight of 1000 lbs. was placed on top of the stand-pipe, and the third test started. The area of a 16-inch circle is roughly 200 square inches; and an increase of 5 lbs. per square inch would be equal to 1000 lbs. When a pressure of 27 lbs. per square inch was reached, the same result was noticed. The air pressure was taken off, and an additional weight of 1000 lbs. placed on the stand-pipe, and the fourth test started. When the gauge showed 32 lbs., the same result followed.

We were satisfied that the trouble was in the flexible joint, and that the line would be safer and more useful if the joint were removed. This was done at considerable expense. Clamps at the top and bottom, held together by rods, prevent any vertical motion of the stand-pipe; while an insulating coupling acts as an expansion joint connecting the land pipe with the submerged one. The tests on this line were about the same as those at Mill river. The joints made under water leaked slightly at first; but they were easily recaulked and made tight, and have not given any trouble since the line has been in use. About 75 gallons of condensation are removed from the drip every month; but this is not river water. The total cost of the work was about £6250.

In the course of the discussion on the paper,

Mr. Shattuck asked the author why he used bell-and-spigot pipe instead of flange pipe. Could not the latter have been laid at less expense, and with less rigging than the former? He would also like to know what pressure the line was intended to carry. He presumed it would be a medium pressure—say, 2 lbs., though it would eventually be more. On the question of electrolysis and the use of Dresser joints at each end for expansion, he thought more or less trouble was caused to keep them tight with the rubber packing, which was apt to give way, and lead to a serious leak. Mr. J. J. Humphreys, jun., asked what good the Dresser coupling would be, seeing that there would be surface water connections with the river which would make just as good a connec-

tion as the pipe itself. He might mention that he had laid two 30-inch pipes, about 200 feet long, 20 feet under salt water, putting the pile supports every 6 feet, and strapping down the pipes with irons on the pile-heads to prevent the wash of the current affecting them, and having flexible joints on the horizontal underwater pipe at both ends. The only trouble of any moment that occurred was two broken pipes where the diver had not held the levelling-rod correctly for the engineer on the surface, and there was a variation of some ½ inch, and the flange pipe broke there. Further than this, the line was practically always tight.

Replying to these remarks, Mr. White said the question of flange pipe or bell-and-spigot pipe was considered. The one great objection to the former was the bolts. The Mill River water was salt. There was a trolley station on the east bank, possibly 700 or 800 feet north of the gas-works; and he was afraid of wrought-iron under water. This was one reason. Another was that there had been laid in their vicinity a 30-inch flanged pipe; and the divers found that it was a very difficult task to draw the flanges together. Consequently it was decided in this case to use a bell-and-spigot pipe. The pressure they were carrying on the pipe-line was 2 lbs.; but it was possible that it would go up to 10 lbs. at some future time. With regard to using the Dresser insulating couplings, he might explain that they knew there were some stray currents on their land pipes in the vicinity of the gas-works; and while the insulating couplings on shore would not prevent any currents in the water from affecting the submerged pipe, they would cut off any currents from the land. The joints were subjected to a rather severe test, and were left exposed for about three months after the line was in use; and the insulating couplings were found to be tight. They had not experienced any trouble. They submitted composition and so-called non-corrosive bolts to an electrolysis expert, and his decision was against using them.

MIDLAND JUNIOR GAS ASSOCIATION.

Visit to the Cannon Iron Foundries.

A party numbering about sixty members of the Association on Saturday afternoon proceeded to Deepfields, in response to an invitation to visit the works of the Cannon Iron Foundries, Limited. Though, in the ordinary course of things, most of the departments had when the members arrived ceased work for the day, arrangements had thoughtfully been made for them to witness in operation one process of particular interest to them, and in connection with which the firm have earned an excellent reputation. On arrival, they were met by Alderman R. Clayton, J.P. (the Chairman of the Company), Mr. Talbot Clayton and Mr. Hawthorne (Directors), Mr. Bert. Hawthorne (the Manager), Mr. Edward Crump (Works Manager), and members of the staff, who accompanied them round the works.

The firm is one which has a long history; for the business was established as far back as 1826, under the style of Edward and Stephen Sheldon. In 1884, the constitution of the firm was changed to that of a private limited company, with the title of the Cannon Hollow-Ware Company. In 1900, however, this title was altered to the Cannon Iron Foundries, because, with the addition of new departments, the business had so increased, both in variety and in extent, that the former designation did not properly indicate the scope of the operations carried on. One of the most important developments was the establishment of a distinct department for the complete manufacture of gas-stoves; and it is gratifying to learn that, right away from its commencement, this step has proved fully justified. In fact, the rapidly increasing requirements of this department some few years ago necessitated the erection of entirely new works on an extensive scale. In these new works everything has been arranged to secure economically a large output. Curiously enough, the completion in the year 1906 of the new works (which are situated on the opposite side of the railway to the older works) coincided with the eightieth anniversary of the foundation of the business.

Altogether, the works cover some 16 acres of ground; and both canal and railway facilities are available. The different departments comprise the making of cast-iron hollow-ware, tinned and enamelled; "Porceliron" sanitary ware; gas-stoves for cooking and heating, &c.; grindstones; builders' and general ironmongery; and black castings, or general iron foundry. Through these departments, the members were conducted; but work for the day having ceased, it was from the stores and warehouses that the visitors were able to derive the best idea of what the firm actually turn out—in addition to the gas appliances with which, of course, all were familiar. The older portion of the works was first gone through; and here there was one exception to the generally prevailing peaceful aspect of the place. This was in the department where the enamelling of cast-iron goods, to which the name of "Porceliron" has been given, is carried out. The members saw a bath and various other articles removed red hot from the muffle-furnaces, dusted with the enamel powder, replaced in the furnaces, and then the same operation subsequently repeated. This porcelain enamel, it was pointed out, is absolutely pure; it being guaranted free from lead or other harmful compounds. With fair usage, it is stated that it has a remarkably long life; and the beautifully smooth surface was generally admired. In the securing of this surface, of course, the skill of the workmen plays an all-important part; and the ingenious manner in which the powder is shaken evenly over the article under treatment was watched intently by the visitors. The bath, for instance, was held on a revolving arrangement which presented each portion of the surface in turn in the position most suitable to receive the attentions of the enamellers.

Passing from here to the warehouses in this portion of the works, an inspection was made of the goods for home, colonial, and foreign use which are made by the Company. Among the bigger articles, there were seen some of those small things which, in the aggregate, do so much to assist in the culinary department of the home. There were pure tin-lined cast-iron kettles, &c., and saucepans designed to increase the heating area, and with rounded corners to facilitate removal of the contents and to offer easier access for cleaning. These, while specially intended to give economical results when used on gas-cookers, are equally serviceable for open fires and ranges. Attention was also drawn to the firm's hexagonal detachable saucepan handles, and their self-vent strainer covers, which also prevent boiling-over and allow of the escape of the steam through the series of holes that are provided over one portion of the edge of the cover. The newer part of the works was subsequently visited; and after passing through the large moulding shop, there was ample opportunity for examining the Company's various makes of gas-fires and cookers, which are so well known that any description of them is not needed.

At the conclusion of the inspection, the party sat down to tea after which due acknowledgment was made of the warm welcome that had been extended to them by the firm.

The PRESIDENT (Mr. R. J. Rogers), in proposing a hearty vote of thanks to Alderman Clayton and his co-Directors for their great kindness in asking the Association to pay a visit to the works, and for their hospitality, said they had spent a most interesting afternoon, and had seen many things which were a little outside those which, in the gas business, they were accustomed to come across. It was evident from the nature of the goods made there, that the specialities of the Cannon Iron Foundries went to all parts of the world. The firm had been styled "enterprising;" and after all they had seen that day, there would be general agreement that it was a description to which they were fully entitled. They had now been associated in business for over eighty years, and had moved along with the times. Their gas fires and apparatus generally were quite on scientific lines; and so long as they kept on in this way, there was no doubt that the business would continue to grow. With the vote, he would like to couple the names of the many gentlemen who had conducted the members round the works and told them all about the business.

Mr. W. H. JOHNS, in seconding the proposal, remarked that, having seen the enamelling carried out, there were no doubt some points on which the members still felt curious with regard to the process; but the secrets they might wish to have divulged to them were, of course, held only by the chemical experts of the firm. At the same time, the visit had been an instructive one; and the members had learnt a great deal, not only about gas-stove making, but as to the splendid enamelling arrangements for the goods sent out by this well-known firm.

Alderman CLAYTON, in acknowledging the vote, said his only regret was that the visit had not taken place when the "wheels were going round." He would have liked the members to have seen all the processes in operation from beginning to end. Then they might have witnessed many things that they were perhaps not so familiar with as they were with the manufacture of gas-stoves. If, however, the members could come again on some future occasion when everything was in full work, he could assure them of a very hearty welcome.

Yorkshire Junior Gas Association.—We learn from the Hon. Secretary (Mr. Edward Garsed, of Elland) that the next meeting of this Association will be held at the Municipal Technical College, Bradford, on Saturday afternoon this week, when a paper will be read by Mr. T. Brooke, of Birmingham, on "Some Retort-House Problems and Difficulties."

Large Venturi Water-Meters.—The New York Board of Water Supply have developed a comprehensive plan for measuring the quantity of water delivered by the Catskill aqueduct; and they have provided Venturi meters at three points in the line, so that a continuous record of the actual flow will be available. The meters are on a colossal scale, and are believed to be the largest Venturi meters ever built. At the upstream piezometer castings, the diameter of the waterway is 17 ft. 6 in.; and at the throat it is 7 ft. 9 in. The water will be collected in the Ashokan reservoir 100 miles north of New York in the Catskill Mountains, and will flow south by gravity through the aqueduct to the Kensico storage reservoir, about 30 miles from the city. Each meter is built of reinforced concrete with a bronze lining and annular pressure chamber at the throat and a second pressure chamber at the upstream end of the tube. The throats of the meters are always to be full of water; and for this reason the tubes were built as inverted syphons, with the throats 18 feet below the hydraulic grade line. The length of the depressed section is about 408 feet, including the 30 feet transition lengths at either end which convert the horseshoe aqueduct section into a 17 feet circular section. The length of the tapered portion of the meters on the upstream end is 26 ft. 3⅜ in., and at the down-stream end 11 ft. 7⅞ in. The flow will be measured by an indicating recorder connected to the Venturi meter tube by two pressure pipes.

REMOVAL OF TAR FROM WATER GAS.

By Dr. A. P. Beardsley, of New Haven (Conn.).

[A Paper read before the New England Association of Gas Engineers.]

The removal of tar is one of the difficult problems connected with the manufacture of water gas. On the manner in which it is accomplished will largely depend the candle-power results obtained; and on the thoroughness of its removal, the satisfactory working of the purifiers. The tests described in the paper were made in an effort to learn what part in the removal of tar is played by each piece of apparatus through which the gas passes.

In order that the bearing of the results may be better understood, a short description of the apparatus at New Haven is first given. The water-gas plant comprises three 8 ft. 6 in. and one 12 feet standard United Gas Improvement sets, all provided with air and steam meters and with pyrometers. The gas from the superheater passes through the usual wash-box and board scrubber; leaving the latter at a temperature a little over 160° Fahr. It is taken to the water-tube condenser through 310 feet of 30-inch steel main, which runs in the open almost all the way, and serves very effectively to cool the gas.

The condenser is of rectangular section, 5 ft. 3 in. wide, 42 ft. 6 in. long, and 11 feet high between the headers; and it is rated at 3½ million cubic feet daily capacity. The gas travels horizontally, while the water passes up and down vertical tubes in a general direction opposite to the flow of gas. The gas enters the condenser at from 135° to 140° Fahr., and leaves it at 120° to 125° Fahr. A relief holder of 100,000 cubic feet capacity is located on a spur on the outlet main of the condenser. Being small, and receiving only a portion of the gas made, it has comparatively little condensing effect. From the exhauster, which is next in series, the gas goes to the Pelouze and Audouin extractor. This has a diameter of 5 feet, and a rated capacity of 5¾ million cubic feet daily. The temperature here is maintained at about 110° Fahr.

Following the extractor are two shaving scrubbers, connected in parallel, each 8 ft. 6 in. in diameter and 23 ft. 6 in. high. Their combined capacity is 2 million cubic feet daily. At this flow, the speed of the gas through them, neglecting the space taken by the shavings, is 12·24 feet per minute. The outlet gas temperature averages 100° Fahr. Last come four purifiers 20 ft. by 30 ft., and 10 ft. deep. Each box has three layers of oxide, through which the gas travels in parallel. With a daily make of 2 million cubic feet, the speed of the gas through the oxide, neglecting the space occupied by the latter, is 0·77 foot per minute, and the time of contact 13 minutes. The gas leaves the purifiers at about 90° Fahr. The oil in use has a gravity of 30° Baumé. The consumption is about 4·5 gallons per 1000 cubic feet, and the illuminating power of the gas about 25·40 candles.

In this apparatus tar is removed from the gas in five stages—viz., by the board scrubber, the condensing system (taken as including everything from the scrubber to the extractor), the extractors, the shaving scrubbers, and the purifiers. We have attempted to determine what percentage of the tar reaching each piece of apparatus is removed therein. It should be understood that the figures given, which were but very recently obtained, represent conditions as they at present exist, rather than as we would, in some cases, like to have them. The purpose of making these tests is to learn the present effectiveness and best method of operation of each piece of apparatus, and to give us knowledge necessary to secure improved results in the future. The data to follow are arranged in tabular form for each of the five stages of tar removal.

Table I.—*Board Scrubber.*

Superheater Outlet.				Scrubber Outlet.			
Oil per 1000 Cub. Ft	Temp. at Base of Heater.	Tar per 1000 Cub. Ft.	Water per 1000 Cub. Ft.	Tar per 1000 Cub. Ft.	Water per 1000 Cub. Ft.	Temperature of Gas.	Tar Removed.
Lbs.	Deg. Fahr.	Lbs.	Lbs.	Lbs.	Lbs.	Deg. Fahr.	Per Cent.
4·76	1300	5·99	7·40	5·31	11·66	160	11·4
4·80	1400	5·03	7·83	3·80	10 87	160	24·4
4·80	1400	6·35	8·85	4·56	10·27	160	28·1
4·79	1366	5·79	8·03	4·56	10·93	160	21·3

According to these figures, 14·2 per cent. by volume of the oil used has become tar. The undecomposed steam leaving the generator amounts to 8·03 lbs. per 1000 cubic feet. The board scrubber produces a sudden and great fall of temperature of the gas, largely at the expense of evaporating 2·9 lbs. of water per 1000 cubic feet. But it does not appear to be very effective as a tar extractor, since it removes only a little over one-fifth of the tar entering it. This allowance must, however, be made. The quantities of tar given in the table are the total quantities which separated out of the gas when cooled to 90° Fahr. in the test. This temperature, which is that of the purifiers, was chosen partly to ascertain the total amount of tar removed from the gas by the whole system of tar extraction, and partly because of serious practical difficulties in estimating the tar at the temperature of 160° Fahr., which the gas possessed when leaving the board scrubber. At this high temperature, a considerable portion of the tar is still present as vapour; and this portion the board scrubber cannot remove.

It is possible that the chief cause of the trouble in the removal of tar—viz., the formation of a very fine fog of tar—may be found here, in the too sudden cooling which the gas experiences in the board scrubber. Fog is formed when a gas containing the vapour of a liquid is cooled below the dew-point or saturation-point of the vapour. If the cooling is quite gradual, the particles first formed gather to themselves the additional liquid which condenses out as the temperature continues to fall; or, in other words, they become nuclei for the formation of larger particles. Thus drops are formed of sufficient weight to fall out themselves, or to be readily removed by mechanical means. If, however, the drop in temperature is very sudden, there is a general and instantaneous formation of minute particles of liquid, so fine as to be easily carried in suspension by the gas, and to resist removal by the usual methods, which depend on the impact of these particles against surfaces presented. If the cooling of the hot gas were made more gradual, it seems possible that the formation of much troublesome fine fog might be avoided.

Table II.—*Condensing System.*

Board Scrubber Outlet.			P. & A. Extractor Outlet.		
Tar per 1000 Cubic Feet.	Temperature of Gas.	Make per 24 Hours.	Tar per 1000 Cubic Feet.	Temperature of Gas.	Tar Removed.
Lbs.	Deg. Fahr.	Cubic Feet.	Lbs.	Deg. Fahr.	Per Cent.
5·31	160	3,500,000	0·58	106	89·1
3·80	160	1,100,000	1·17	103	69·2
4·56	160	1,100,000	0·92	97	79·8
4·56	160	..	0·89	101	79·4

To correspond with the conditions of the test at the board scrubber outlet previously described, the determinations at the extractor inlet were made at 90° Fahr. instead of at the temperature of the gas, as was the case in Tables III., IV., and V. The figures, therefore, represent a certain amount of condensed tar vapour as well as tar fog.

More tar is taken out in the condensing system than in all the other processes combined—the amount, according to the preceding figures, being 80 per cent. of that entering the condensing system, or 63 per cent. of the total tar made. Other tests of the quantity of tar present at the inlet of the extractor indicate that this figure of 80 per cent. should probably be increased to 85 per cent. There is still left, however, from 12 to 15 per cent. of the original amount to be removed.

Table III.—*Pelouze and Audouin Extractor.*

Inlet.			Outlet.			
Tar Fog per 1000 C. Ft.	Temp. of Gas.	Make per 24 Hours.	Differential Pressure.	Tar Fog per 1000 C. Ft.	Temp. of Gas.	Tar Removed.
Lbs.	Deg. Fahr.	Cubic Feet.	Inches.	Lbs.	Deg. Fahr	Per Cent.
0·458	89	1,100,000	2	0·144	86	68·6
0·434	90	1,100,000	2	0·147	86	66·2
0·400	108	3,500,000	4	0·105	104	73·5
0·355	108	2,400,000	4	0·082	104	76·9
0·487	112	3,500,000	8	0·086	110	82·3
0·695	96	3,500,000	8	0·138	86	80·1

With a very large quantity of tar in the gas, we have obtained an efficiency of 92 per cent. from the extractor; but such a condition is unusual. The influence of the differential pressure on the results is quite marked. A change from 2 to 8 inches causes a rise of efficiency from 67 to 81 per cent. It is necessary that the difference of pressure should be kept both high and constant. Our usual difference has been about 6 inches, at which the extractor removes some 80 per cent. of the tar which reaches it.

Table IV.—*Shaving Scrubbers.*

Extractor Outlet.			Shaving Scrubber Outlet.			
Tar Fog per 1000 C. Ft.	Temp. of Gas.	Make per 24 Hours.	Time in Passing Scrubbers.	Tar Fog per 1000 C. Ft.	Temp. of Gas.	Tar Removed.
Oz.	Deg. Fahr.	Cubic Feet.	Min.	Oz.	Deg. Fahr.	Per Cent.
0·765	120	2,200,000	2·00	0·083	100	89·2
1·651	110	2,200,000	2·00	0 219	96	86·8
1·446	108	2,200,000	2·00	0 166	102	88·5
2 670	128	3,500,000	1 25	1·185	118	55·6
1·640	94	3,500,000	1 25	0·758	90	53·8
2·540	100	3,500,000	1·25	1·206	98	52·5
2·229	104	3,500,000	1·25	1·083	100	51·4

It will be noticed that the scrubbers perform the fairly satisfactory work of removing 88 per cent. of the tar coming to them, when the flow of gas is about their rated capacity of 2 million cubic feet daily. But their efficiency falls off with an increased make till it is only 53 per cent. when the rate of flow is 3½ millions daily. Apparently a certain time of contact with the shavings is necessary; and this must not be less than two minutes. In calculating this figure, no allowance was made for the space occupied

by the shavings. The actual time of contact is therefore less than the apparent.

Both the extractor and the shaving scrubbers act as mechanical removers of tar fog; and a comparison is natural of the costs of removing tar by the two systems. In the first place, the space needed is far different. On the basis of maximum rated daily capacity, the extractor, including connections, occupies 21 square feet and 430 cubic feet of space per million feet of gas treated; the corresponding figures for the shaving scrubbers being 148 square feet and 5624 cubic feet. The size of the last figure is partly due to the height required for the apparatus used in filling the scrubbers with shavings. On the same basis of gas treated, the costs of installation are in favour of the extractor in the ratio of 1:6·6. Yet it seems doubtful whether the work of the shaving scrubbers could be so well done by an additional extractor. The removal of tar fog in the extractor is due principally to the momentum given to the tar particles by their velocity, which causes them to impinge on the baffle-plates of the apparatus. The very fine particles may not receive the necessary momentum, and there will be left a certain amount of very fine fog, for the removal of which shaving scrubbers are necessary. How complete the filtering action (if it may be so called) of the scrubbers can be made, is indicated by the figures obtained for the purifiers, which are given below. The same sort of filtering action takes place in the purifiers as in the shaving scrubbers.

TABLE V.—*Purifiers.*

Inlet.			Outlet.			
Tar Fog per 1000 C. Ft.	Temp. of Gas.	Make per 24 Hours.	Time in Passing Oxide.	Tar Fog per 1000 C. Ft	Temp. of Gas.	Tar Removed.
Oz.	Deg. Fahr.	Cubic Feet.	Min.	Oz.	Deg. Fahr.	Per Cent.
2·303	119	3,500,000	7·4	0·032	90	98·6
2·783	90	3,500,000	7·4	0·067	97	97·6
2·508	112	3,500,000	7·4	0·035	96	98·6
1·242	97	3,500,000	7·4	0·032	93	97·4
0·529	80	2,400,000	10·8	0·010	83	98·0
1·252	82	3,500,000	7·4	0·025	90	98·0
1·160	105	3,500,000	7·4	0·028	92	97·6
		Average				98·0

The time of passing through the oxide is figured without regard to the space occupied by the latter. The actual time of contact is, therefore, less. In the first three cases above, there was, for some unknown reason, an extremely large quantity of tar in the entering gas; yet the purifiers removed it practically all. This is, of course, bad for the purifiers, but interesting as showing how effective the filtering-out of tar fog may be made.

The writer is aware that there are inconsistencies in the results given in the paper. For example, the individual determinations which compose Tables I. and II. do not check closely. The quantity of tar present at any given point varies from time to time. For some of these irregularities reasons can be assigned; for others, at present, none. The determinations at the inlet and outlet of a piece of apparatus were always made simultaneously and with much care. It appears fair to assume that the results, in the main, indicate actual conditions. We hope that they are going to prove of value to us in improving our methods of operation, and that they will be of interest to those to whom the paper is addressed.

[In an appendix to the paper, the author described the methods he employed to determine the quantity of tar in gas.]

We have received from Mr. Harry J. Donkin a copy of a pamphlet he has prepared on the history of the firm of Bryan Donkin and Co. in the century from 1803 to 1903—the period of its existence in London, as in the last-named year the business was removed to Chesterfield. The founder of the firm started as a manufacturer of the moulds used for hand-made paper; but he subsequently devoted his attention to the production of paper-making and printing machinery. In the early part of the last century, he was associated (among others) with Boulton and Watt and Murdoch; and the firm have still in their possession drawings signed by them. The founder died in 1855, at the age of 87; and three years later, the firm consisted of his two sons Bryan and Thomas and Mr. B. W. Farey. Another Bryan Donkin, a grandson of the founder, was shortly afterwards taken into partnership; and it was he who turned his attention to internal combustion engines, and produced his well-known work on the subject. In the second half of the century, the firm became identified with the production of plant connected with the gas industry. The manufacture of gas-exhausters, which has become so important a section of the business, commenced with the taking-up of one of Beale's patented designs in 1866. This has been superseded by later improvements, notably by one for which a patent was taken out by Mr. Edwin Bryan Donkin, who has turned his attention chiefly to developing the business in gas-works apparatus. He, Mr. Bryan Donkin, and the author of the notes, were the only surviving members of the family interested in the concern, which is now a limited Company, at the commencement of the present century. The pamphlet furnishes an interesting record of the progress of an important firm.

WATER SUPPLY OF BIRMINGHAM FROM WALES.

Description of the Scheme.

At a recent meeting of the Institution of Civil Engineers, a paper was submitted by Messrs. E. L. & W. L. MANSERGH, MM.Inst.C.E., in which they described, by the aid of three large plates and several diagrams in the text, the scheme for the supply of water to Birmingham from Mid-Wales which was designed and carried out by the late Mr. James Mansergh, M.Inst.C.E. Indications of the nature and extent of these great works have from time to time been given in the "JOURNAL;" but the particulars furnished by gentlemen intimately connected with them, will have special interest for water engineers.

INCEPTION OF THE SCHEME.

The authors opened their paper with a short review of the circumstances which led to the adoption of the scheme. They remarked that the City of Birmingham stands on high ground; and within the boundaries of the borough the elevation above Ordnance datum varies between 300 and 600 feet. According to the 1891 census, the population was 648,000; and the demand for water was then approaching 15 million gallons a day. The local sources from which the city and the surrounding districts were supplied before the Welsh water came into use were five streams and six wells in the new red sandstone; and they afforded about 20 million gallons a day. In 1890, the late Mr. James Mansergh was consulted by the Water Committee on the question of an additional supply to the district; and full inquiries were made as to the possibility of adding to the yield of the above-named sources. In the result, the recommendation made to the Committee was that they should secure the control of the watershed of the Rivers Elan and Claerwen in Radnorshire, which was at a suitable elevation to enable the water to be delivered into a service reservoir near Birmingham at such a level that it could be supplied to a very large portion of the district by gravitation, and was of sufficient area to meet the requirements of the city and district for two or three generations. This scheme was approved by the Council and laid before Parliament in the session of 1892, when the necessary powers to carry it out were obtained. These cover the full utilization of the yield of the watershed and works necessary for a total supply of 75 million gallons per day to the city and district. The drainage area of the two rivers above the Caban Côch dam is 45,562 acres, or 71·19 square miles; the level of the river bed at the dam is 700 feet above Ordnance datum.

RESERVOIRS AND DAMS.

Of the six reservoirs comprised in the scheme, three have been constructed—viz., the Caban Côch, the Pen-y-gareg, and the Craig Gôch. The dams for these reservoirs are respectively 122, 123, and 120 feet in height above the bed of the river, are 610, 528, and 513 feet long, and provide storage for 7815, 1330, and 2000—a total of 11,145—million gallons. The other three reservoirs are the Dol-y-mynach, the Ciloerwynt, and the Pant-y-beddau. The dam for the first-named reservoir will eventually be 101 feet high and 940 feet long, and provide storage for 1680 million gallons. The other two reservoirs will be 108 and 98 feet high respectively, 1053 and 720 feet long, and provide storage for 3150 and 1940 million gallons. These three reservoirs will give an additional storage of 6770 gallons.

A novel and interesting feature of the scheme is the submerged dam constructed across the Caban Côch reservoir at a place called Caregddu, about 1½ miles higher up the River Elan than the Caban Côch dam itself. This dam is for the purpose of holding up the water to the required level to charge the upper end of the aqueduct without involving the loss of storage for compensation purposes in the Caban Côch reservoir. It was found that, in order to give the most economical cross section and the best line, the fall required in the 74 miles of aqueduct between the Elan valley and the Frankley reservoir was approximately 170 feet. The top water-level of the Frankley reservoir had to be at about 600 feet above Ordnance datum, and therefore the invert of the aqueduct at the Elan end was necessarily about 770 feet above Ordnance datum, or 70 feet above the bed of the river at the Caban Côch dam. The problem was to keep the water up at this level in the Caban Côch reservoir, so as to charge the aqueduct at all times, and also to utilize to the fullest extent possible the vast storage capacity in the lower portion of the reservoir.

In plan, the Craig Gôch dam is an arc of a circle of 740 feet radius, and it carries a public road bridge. The roadway, which is narrowed to the smallest feasible limit, is 9 ft. 6 in. between the parapets; and the bridge consists of thirteen openings of 30-feet span, forming an overflow having a net length of 390 feet. The drainage area above the dam is 13,700 acres; and provision was made in the culvert for carrying off water during construction at the rate of about 190 gallons per minute per acre. To discharge this, a circular culvert 17 ft. 6 in. in diameter was required, working under a few feet of head. It was constructed on the left bank of the river, and its invert level was about 17 feet above the bed. It was, however, never called upon to discharge the full amount, though it was filled within 2 feet of the crown on several occasions.

The middle of the dam for the Pen-y-gareg reservoir is occupied by a valve-tower, immediately above a culvert which pierces the

base of the dam; the invert being 123 feet below the crest. The first operation in the construction of this dam was the excavation of a temporary cut on the left bank of the river for the passage of the water while the excavation was got out in the river bed and right bank and the dam and culvert were built up to 850 feet above Ordnance datum on the western side of the valley. The culvert was 18 feet in diameter, straight in plan, with its invert level at 822 feet; and it had to provide for the discharge of flood-water from a drainage area of about 16,000 acres. When the above-mentioned block had been completed, the river was turned through the culvert, and excavation and building were taken in hand on the eastern portion until the same level was arrived at, after which the work proceeded over the whole length of the dam. Water is drawn from the Pen-y-gareg reservoir into the Caban Côch reservoir through a vertical stand-pipe in the valve-tower 24 inches diameter, having branches communicating with the reservoir at five different levels. Each branch is controlled by two sluice-valves—one worked by hand, the other by hydraulic power.

The dam of the Caban Côch reservoir is situated about seven furlongs below the confluence of the Elan and Claerwen; and when the reservoir is full, the top water tails out at about 4⅛ miles up the Elan valley, at the toe of the Pen-y-gareg dam, and 2⅛ miles up the Claerwen valley, at a point where the partially-built Dol-y-mynach dam is situated. At this point the flood-water from the whole watershed of 45,562 acres had to be dealt with. In view of the large area, it was assumed that provision should be made for a discharge of 93 gallons per minute per acre—representing a volume approaching 4½ million gallons per minute. During construction, flood-water was carried off by two culverts, 16 feet in diameter, one on each side of the river, with their inverts at 700 feet above Ordnance datum.

Compensation Works, &c.

The quantity of compensation water to be discharged into the River Elan was fixed by Parliament at 27 million gallons per 24 hours, in a regular and continuous flow; the point of discharge to be within 300 yards of the Caban Côch dam. A clause was also inserted in the Corporation's Act empowering the Board of Conservators of the River Wye to require the Corporation to create freshets in the river from time to time, upon due notice being given, by reducing the daily compensation water to 22 million gallons, and accumulating the difference of 5 million gallons for any period not exceeding 21 days, and discharging the quantity so accumulated in a regular, equal, and continuous flow during 48 hours in addition to the daily compensation water. It thus became necessary to provide apparatus for accurately measuring three different rates of flow; and after considerable discussion with the late Dr. G. F. Deacon, M.Inst.C.E., who was appointed to represent the Wye Conservators, and Mr. J. Parker, M.Inst.C.E., representing the City of Hereford, it was decided to adopt the principle of gauging the water by discharging it through rectangular orifices under a fixed head.

On each side of the river there are three of these orifices, 49 in. by 12·25 in., 23 in. by 5·8 in., and 37·28 in. by 9·32 in. They are all fixed with their centres 4 feet below top water-level of the receiving-tank; and under this constant head they discharge, in round figures, 22 million, 5 million, and 12¾ million gallons respectively per 24 hours. In ordinary working, the first and second orifices are open and the third one closed. When water is being accumulated for a freshet, the first orifice alone is open. When accumulations are discharged for a freshet, both sets of works, with all orifices open, are required; the maximum to be reached being 79⅛ million gallons per day. The compensation water flowing through the orifices falls into a channel leading to a short culvert 5 feet high by 4 ft. 6 in. wide through the channel-wall, and is discharged into the main channel at an invert level of 695 feet above Ordnance datum; the direction of discharge being at an angle of 45° with the centre line of the channel.

Power-Houses, &c.

The constant discharge of compensation water from the Caban Côch reservoir provided a source of power which it was decided to utilize for various purposes in connection with the working of the scheme. Arrangements were accordingly made for the erection of a 20 H.P. vortex turbine upon the line of each compensation main just above the receiving-tank. Each turbine is designed to work on a fall of 26 feet (using about 3400 gallons of water and making 280 revolutions per minute) and drives a set of small high-pressure pumps working against an accumulator, and a dynamo for supplying current to the lift and for lighting.

At a later stage of the work, the addition of the roughing-filters near the head of the aqueduct necessitated the provision of a large increase in power to drive the pumps supplying filtered water under pressure for sand-washing, and to give the current required for the electric conveyors and large arc lights installed at the filters. It was therefore decided to erect additional and more powerful turbines above the others, so that either set or both could be used as desired. The larger plant consists of 75 H.P. twin turbines, each being designed to develop its maximum power under a head of 24 feet, using rather more than 18,000 gallons of water per minute, at a speed of 350 revolutions. Each turbine is coupled direct to a dynamo, which, at the same speed, is capable of giving 40 kilowatts at 500 volts.

Foel Valve-Tower.

This tower, at the head of the aqueduct, is situated on the left bank of the Caban Côch reservoir, about 200 feet up-stream from the submerged dam. It is circular in plan; the outer face being divided into eight panels by projecting buttresses running from top to bottom. The lower portion is 42 feet in diameter outside the buttresses, and 30 feet in internal diameter. It is carried up to a height of 836 feet, where it is capped by a parapet wall 3 ft. 6 in. high. The upper portion, which forms the valve-house, is 29 ft. 6 in. in external and 25 feet in internal diameter. The domed roof is of timber covered with copper.

The lower portion of the tower is divided internally into two semicircles, the outer of which forms a wet well containing the draw-off pipes. The other half is solid, with the exception of a circular shaft 12 feet in internal diameter, up which are carried the valve-rods from the second system of valves, and which also contains a spiral stairway giving access both to the valves and to the Foel tunnel. The draw-off pipes in the wet well consist of three vertical tiers of steel cylinders, 5 ft. 6 in. diameter, so arranged that any number of cylinders in any column can be lifted apart, and water allowed to flow into the interior of the column at any multiple of 2 feet below top water-level of the reservoir down to a height of 778 feet. Each column is 48 feet high over all. Each pipe column is capable of discharging the full quantity available for supply—viz., 75 million gallons per diem—with a head of 2 feet over the lip of the cylinder. Each cylinder can be lifted 2 feet from the cylinder below it. The discharge-chamber is separated from the valve-chamber by a wall of brickwork and concrete 6 feet thick carried up to 780 feet, at which level there is a doorway forming the means of intercommunication between the tower and the tunnel.

Elan Filtering and Hardening Plant.

The screening arrangements and filters installed at the outlet end of the Foel tunnel were not included in the original scheme, but were the result of information furnished by Mr. Joseph Parry, M.Inst.C.E., the Water Engineer to the Corporation of Liverpool, regarding the serious diminution of the discharging capacity of the main between Lake Vyrnwy and the Oswestry filter-beds, owing to the coating of the pipes with a blanket-like deposit. This deposit did not occur on the Liverpool side of the filters; and, after consultation with the late Professor (Sir Rubert) Boyce, the late Dr. Campbell Brown, and Mr. Parry, the Birmingham Corporation were advised to put in these works, whereby the water would be screened and roughly filtered before it passed through any of the syphons where this deposit could accumulate. The only site available was a costly one, involving about 300,000 cubic yards of cutting in the hillside.

The filters are thirty in number. Each has an area of 450 square yards, being, roughly, 81 ft. by 50 ft.; the actual shape varying slightly to fit in with the configuration of the ground. They are constructed of concrete; the walls being faced with blue brick above the level of the sand, and finished with stone copings. The filtering medium is necessarily of a coarse nature, and consists of rock crushed to about ⅝-inch gauge. After passing through the filtering medium, the water is collected in the drains in the usual manner, and brought to the outlet chamber, which is controlled by sliding-gauge sluices, over which the water passes to the outlet culvert. The water from all the filters is collected in this culvert, and is then gauged through submerged orifices.

The Aqueduct and Syphons.

The total length of the aqueduct, from the Foel valve-tower to the Frankley service reservoir, is 73 miles 658 yards. It consists of two main classes of work: (1) Conduit, either in tunnel or "cut and cover," designed to carry the full quantity of water available from the drainage area. Of this conduit there is a total of 36 miles 1248 yards. (2) Inverted syphons of cast-iron or steel, of which two pipes out of six have already been laid. The length of syphon was 36 miles 1170 yards. The first class embraces "tunnel" of an aggregate length of 12 miles 1556 yards, and "cut and cover" of an aggregate length of 23 miles 1452 yards. There are in all fifteen separate tunnels—nine more than 500 yards in length and six not exceeding 500 yards each—on the whole line; the longest being the tunnel between Dolau and Bleddfa, 4 miles 464 yards in length, and the shortest the tunnel at Hagley, close to the Severn syphon outlet, 183 yards in length. There are eleven syphons, with an aggregate length of nearly 36¾ miles. The shortest, across the valley of the Lugg, in Radnorshire, is 552 yards long; and the longest, across the valley of the Severn and its tributaries, is 17 miles 234 yards. When the full quantity of water procurable from the watershed is being delivered to Birmingham, the syphons will consist of six lines of pipes; but for the first instalment of 25 million gallons per day two lines only have been laid. The valve-chambers, bridges, &c., have, however, been constructed for three lines of pipes in almost every instance. The portion of the aqueduct which, in relation to its length, involved the largest expenditure and some of the heaviest work was that between 725 feet west and 1100 feet east of the centre of the River Severn. The cost of the works in the total length of 1825 feet was about £87,000.

River Crossings and Bridges.

There were altogether 26 rivers and streams of a fair size to be crossed by the aqueduct where in syphon; and at all of these, with the exception of five, the pipes were carried over the stream above flood-level. As a rule, the streams were spanned by straight steel or cast-iron pipes laid between masonry abutments, and carrying themselves and their contents; but in the case of

five rivers and one railway, bridges were built to carry the pipes. These are over the River Teme at Leintwardine, Downton-on-the-Rock, and Ludlow respectively; over the River Severn, between Bewdley and Arley; over the Staffordshire and Worcestershire Canal, near Cookley; and over the Oxford, Worcester, and Wolverhampton branch of the Great Western Railway, near Hagley. The bridge over the Severn valley and river is the largest on the aqueduct; being 624 feet long over all, and constructed throughout for six lines of pipes. It has on the west side five segmental land arches, built of blue brick with stone facings; a river span of 150 feet, consisting of four segmental arched steel ribs; and a heavy abutment on the east side.

Frankley Reservoir and Filter-Beds.

The Frankley service reservoir, at the termination of the aqueduct, is situated on high ground about six miles south-west of the centre of Birmingham. Its top water-level is 603 feet above Ordnance datum, and its capacity is just over 200 million gallons. It is semicircular in plan—the radius to the toe of the curved wall being 780 feet; and it is divided into two quadrants by a central division wall. Since the works were brought into operation, a length of 100 feet of the main division wall has been cut down to 6 inches below the top water-level, in order that the water may be decanted from one division to the other. This was found to be desirable in connection with the chalking of the water already alluded to, for the purpose of allowing for subsidence before the water is taken to the filters.

On the east side of the Frankley reservoir, 18 sand filters were constructed, having a total sand area of more than 14 acres. The beds were made of various shapes and sizes to suit the site; the largest being 220 feet, and the smallest 150 feet, square inside the walls. There is ample room for extending the filtering area when required; the positions of 24 more beds having been provisionally determined. The filters are of the ordinary "slow sand" type, with arrangements for gauging the inflow to each bed—the rate of outflow being controlled by a sliding weir. The average thickness of the filtering material is 5 feet; the top 2 ft. 6 in. being sand, and the rest gravel. The working depth of water over the sand at its full thickness is 2 ft. 6 in.; and the top of the coping to the walls is 1 ft. 6 in. above this level. The beds are designed for a maximum rate of filtration of 450 gallons per square yard per 24 hours—that is to say, a velocity through the sand of 4 inches per hour.

Pumping-Station, &c.

Although the bulk of the Welsh water is conveyed to the inhabitants of the district of supply by gravitation from Frankley, pumping has still to be resorted to for some small high-level areas. Two additional service reservoirs were constructed—one at Warley, about 3½ miles to the north of the Frankley reservoir, and the other at Northfield, about ¾ mile to the south of it. The pumping-station at Frankley is on the eastern side of the covered pure-water tank, receiving the water from the filters; and the plant installed comprised three vertical triple-expansion surface-condensing steam-engines, working three sets of three-throw plunger pumps. Two of these engines and pumps were for pumping to Warley and Northfield respectively, and the third was a stand-by.

Subsidiary Works and Cost of the Scheme.

In addition to the water-works, a considerable number of subsidiary and ancillary works had to be carried out. On the watershed, in addition to 36 miles of temporary railway, about 17 miles of permanent public highways had to be constructed, with numerous bridges, culverts, and fence-walls, wire and other fences, and also a large quantity of pitching and beaching of the sides of the reservoirs. The construction of the works on the watershed and a length of about two miles of the aqueduct below the Elan filters was done by direct administration, under the supervision, as Chief Resident Engineer, of Mr. G. N. Yourdi, M.Inst.C.E., at a cost of £1,810,000. The whole of the remainder of the aqueduct, the Frankley works, and the mains into the city and district, were carried out by contract. The total cost of the whole scheme, including land, was, in round figures, £5,750,000.

Hull Water Supply.—According to the annual report of the Water and Gas Engineer of the Hull Corporation (Mr. Charles B. Newton, M.Inst.C.E.), the total quantity of water supplied for all purposes last year was 4,100,346,000 gallons, of which 4,058,196,000 gallons was used within the water limits of the Corporation; 3,142,344,000 gallons being for domestic and unmetered trade supplies, and the rest for metered supplies. The total daily supply within the limits was 11,118,000 gallons, or 38·22 gallons per head. During the year, there was a net increase of 6579 yards, or 3·74 miles, in the length of mains; bringing the total up to 276·56 miles.

Gas Workers' Wages Increased at Walsall.—The Gas Committee of the Walsall Corporation, having considered a memorial from the workmen for an increase in wages, and after interviews with deputations from the workmen, have decided to make the following increases: Retort-house hands, 3d. per shift, or 1s. 6d. a week of six days; labourers and purifier men, 1s. 6d. per week; lamplighters, 1s. per week, with a reefer jacket and cap allowed each year, and an overcoat every two years, conditional on their relinquishing all outside work. These increases do not apply to old or infirm men or to youths under 21 years of age. Instructions have been given that in future the workmen in the Gas Department be allowed seven days' holiday in the year, with full pay for a full year's work—Bank Holidays to form part of such seven days. Any man at work on Good Friday or Christmas Day is to be paid time-and-a-half.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents*]

The Ilkeston Gasholder.

Sir,—In the "Journal" for the 2nd inst., there was a very interesting article by Professor F. K. Th. van Iterson, of Delft, in regard to the wind-pressure on a gasholder. He used a distribution of wind-pressure based on experiments carried out in the Aerodynamical Laboratory at Delft. I am pleased to say that these experiments agree entirely with those made by me, and contained in a paper on "Wind Pressure on Buildings and other Structures," read before the Institution of Gas Engineers on May 3, 1899, which was published in the "Journal," for the 9th of May that year (p. 1203). It will be seen that my diagram fig. 10 (p. 1204) agrees very closely with fig. 3 in the article to which I refer.

All calculations regarding wind pressures on cylinders have hitherto been based on the erroneous supposition that the wind only acts on the windward side. The section—the greatest part of it—is not taken into consideration; and Professor van Iterson well deserves thanks for having shown this, and made a calculation based on the right theory. He at first employed in his calculation a wind pressure of 41 lbs. per square foot (the German standard); but he afterwards estimated it on a certain day at less than half of this. I think it should be reduced to much below half when it is only a "a strong wind."

In my paper, I mentioned that the greatest wind pressure found in America under destroying tornadoes was about 50 lbs. Sir John Wolfe Barry observed maximum wind pressures on the Tower Bridge of 6 to 9 lbs. on small areas, and of 1 lb. to 1½ lbs. on the large area, per square foot. I have directly measured the wind pressure on a gasholder, 120 feet diameter, under a heavy gale at 3 lbs. per square foot.* I therefore suppose that the wind pressure on the Ilkeston holder can only have been a very few pounds per square foot.

Copenhagen, April 6, 1912. J. Irminger.

* See article on "The Influence of Wind on Gasholders," in the 'Journal' for May 4, 1897 (p. 986).

Financial Results of the Miners' Strike.

In an editorial article headed "After the Strike," in the "Iron and Coal Trades Review" last Friday, the financial results of the strike were set forth as follows: "Out of twenty miners' Unions, nine are entirely without funds, and several others (if we take into account the fact that the published balances of the Unions represent not cash in hand but the nominal value of securities) must be practically in the same condition. Only some four or five Unions will emerge from the conflict without being very seriously crippled; and probably even these, having regard to the necessity of forced realization of securities, are by no means so well situated as published figures seem to indicate. The loss in wages in the coal-mining industry in the six weeks is estimated at £7,000,000; and it is probable the loss in wages in the other industries of the country has been of equal amount—making a total loss of £14,000,000. The Trade Unions had paid out £1,500,000 a week ago; and individual workers will have spent an even larger sum out of their earnings. The retail traders of Great Britain will have suffered to the extent of about £9,000,000. The railway traffic returns already published show a diminution of £3,200,000; and as this loss is still going on, it is probable the shrinkage of receipts will reach £4,000,000 or more before work is resumed. The Chancellor of the Exchequer in his Budget speech estimated the loss to the national tax revenue as £600,000. Many thousands of miners will never be able to make good their personal losses; and it is safe to say that these losses will greatly exceed all the individual gains which can possibly accrue from the passing of the new Act for many years to come."

Prepayment Charges at Wallasey.—At the last meeting of the Wallasey Town Council, it was resolved that "all previous resolutions regarding the charges for the penny-in-the-slot gas consumer be rescinded, and that a new rate be made of 30 cubic feet for 1d., with a rebate of 2d. in the shilling."

Gas to the Rescue at Cowdenbeath.—A burst in the cable of the Fife Electric Power Company on the evening of the 2nd inst. caused considerable inconvenience in the town of Cowdenbeath, especially at the Empire Theatre, where there was a particularly large audience. But as neither light nor power was available, the admission money had to be returned, or checks given for a future performance. The accident was facetiously chronicled on the following Saturday in a local paper as follows: "'The Light that Failed,' an electrifying drama in one act, was produced at the Empire Theatre on Tuesday evening. The title *rôle* was capably embodied by the Fife Electric Power Company." This Company's dilemma was the Gas Company's opportunity. On the afternoon of the 3rd inst. their services were required at the Empire, and by six o'clock, under the direction of the Engineer and Manager (Mr. J. B. Scott) an effective gas installation had been introduced into the building, which enabled the evening performance to be given. It was feared that a trio of aërial gymnasts would be unable to give their sensational performance, owing to the light difficulties; but so effective was the service of gas provided for the stage that they were able to give the whole of their turn. "At so short a notice," said the local paper, "the performance of the Gas Company was an object-lesson in promptitude and effectiveness." The Company followed it up with two of the boldest advertisements we have ever seen in a local paper, emphasizing the reliability of gas, and advising the inhabitants to use it for lighting, heating, cooking, and power—at the same time reminding them that the services of the Company's officials are at all times at their disposal.

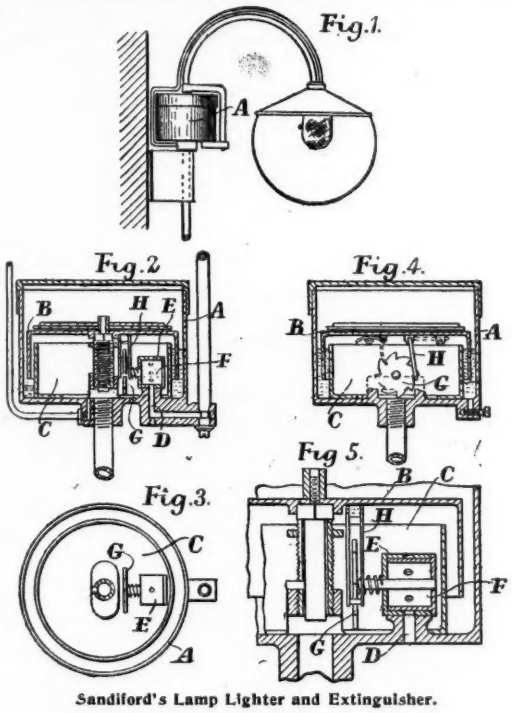
REGISTER OF PATENTS.

Lighting and Extinguishing Gas-Lamps.

SANDIFORD, T. M., of Masterton, New Zealand.

No. 5470; March 4, 1911.

This apparatus for lighting and extinguishing gas-lamps is of the type in which a floating bell is adapted to operate step-by-step mechanism in order to admit or shut off the supply of gas to the burner; the lighting and extinguishing being controlled from a point where the gas pressure for the whole service is regulated.



Sandiford's Lamp Lighter and Extinguisher.

Fig. 1 shows a street gas-lamp governed by the apparatus. Fig. 2 is a sectional elevation, fig. 3 a plan, and fig. 4 a cross section of the apparatus. Fig. 5 is a part sectional elevation corresponding to fig. 2 to a larger scale.

Within the chamber A is a bell B, which dips into an annular space filled with mercury, to form a gas-tight seal between the chamber C and the chamber A. The bell is supported upon a central post guided in a cylinder screwed into a bridge integral with the chamber A. A stop projecting from the post is adapted to slide in a slot in the cylinder, so as to prevent the post from rotating and at the same time limiting the downward travel of the post while limiting its upward travel by engaging an adjustable nut threaded upon the outside of the cylinder.

An outlet D from the gas-chamber communicates with the pipe leading to the lamp. It also communicates with the interior of a cylindrical drum E through an opening in its lower periphery; the drum being arranged horizontally and fixed near the bottom of, and on the inside of, the gas-chamber C and open at the rear end. Within the drum E another drum F is fitted; a spindle to which the latter drum is fixed extending through the end of the drum E. It has provided upon it a toothed wheel G; while a spring upon the spindle is in compression between the end of the drum E and the wheel, and thus retains a tension upon the drum F in relation to the other drum. There is a bye-pass opening in the top of the drum E; while the drum F is provided with bye-pass openings arranged at intervals in its periphery and in line with the openings, so arranged that there is communication between the gas-chamber and the outlet D for gas to pass through.

When it is desired to operate the apparatus by increased pressure of gas, the wheel and drum are rotated by a link H, pivoted in a lug provided upon the interior of the bell; the lower bar of the link being adapted to engage the teeth of the wheel G, as shown. Assuming that the wheel, drum, and link are in the appropriate position, upon the bell top B rising, owing to increased pressure within the gas-chamber C, the bell top will take with it the link H, thus rotating the wheel G and drum F, so as to make communication between the gas-chamber and the outlet D. The height to which the bell rises being limited by a stop, there is no possibility of the drum F being carried beyond the position required. Upon the pressure again becoming normal, the bell returns to its original position, the link H riding over the back of the teeth—sufficient tension being given to the drum F by the coil spring to prevent it being moved upon the return downward travel of the link. Gas now flows from the chamber C, through the drums, into the supply pipe to the burner, where it is lit by the pilot leading from a convenient part of the gas supply—say, the bottom of chamber A.

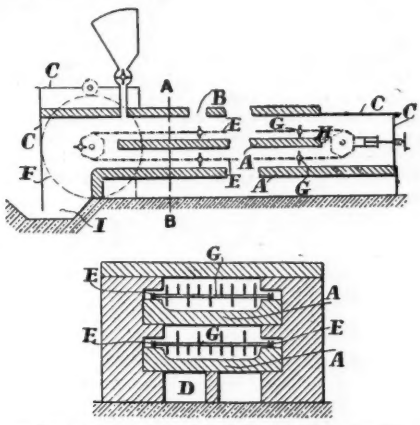
To extinguish the lamp the pressure is again increased; and the bell top B rising, the link H again rotates the wheel G the distance of one tooth, which secures the shutting-off the gas and extinguishing the lamp. Upon, however, the pressure again becoming normal, the bell descends and the link rides over the teeth to its normal position as before, and is ready to operate the wheel when the next application of increased pressure takes place.

Furnace for the Combustion of the Sulphuretted Oxide of Gas-Works.

WYLD, W., of Nechells, Birmingham.

No. 5751; March 8, 1911.

This plant is for the combustion of sulphuretted oxide of gas-works for the purpose of generating sulphurous gases to be supplied (say) to a "Glover" tower of a sulphuric acid plant. It is, however, useful in a variety of other instances in which it is desired to stir material while being heated, both where the heat is generated by the combustion of the material itself (such as in the case of sulphuretted oxide) and also in cases in which the material is subjected to a process of close heating—in processes of sublimation.



Wyld's Furnace for Burning Sulphuretted Oxide.

The illustration shows a sectional elevation of plant for treating sulphuretted oxide, and an enlarged sectional end elevation.

The hearths are constructed of fire-clay slabs A, preferably tongued and grooved; and at each side ledges are formed to carry chains and protect them from the action of the burning material.

The channelled slabs are supported upon encasing walls as shown; the upper hearths being covered by slabs which give easy accessibility to the interior of the plant. A suitable opening B is formed, to allow of the escape of the products of combustion to (say) the "Glover" tower.

Casing plates C are erected, so that the treatment chamber is entirely enclosed; and sliding doors are arranged at the entrance of the flue D. Two endless parallel chains E are geared on drums or sprocket wheels, keyed on shaftings supported by bearings fixed in the side walls. Upon the front axle and outside of the casing, a spur wheel F is fixed and geared with a pinion working on a suitable shafting rotated by any approved means. The two parallel chains are thus caused to travel from end to end of each hearth in turn.

At equal distances in the chains, and at right angles to them, are inserted a number of stirrers G; a pair of slotted links being used to carry them. The stirrers are assembled at their extremities within rectangular apertures in the respective links of the chain, so that they are maintained vertical in relation to the horizontal disposition of the chain. The teeth for operation are in the nature of projecting lugs, which, while stirring and agitating the material and at the same time gradually conveying it, are by no means in the nature of complete scrapers, which would convey the entire contents of the hearth at a speed corresponding with that of the chain.

The material to be consumed is fed from a hopper, the lower portion of which consists of a cylindrical casing, pierced at its periphery by openings for feed and discharge. In the cylinder a shaft containing several radial blades is rotated by an eccentric rod connected on the driven shaft, or by other means. The material, upon being discharged from the hopper on to the upper hearth, is carried forward by means of the travelling stirrers. Upon the material reaching the end of the first hearth, it falls on to the lower one at H, and finally the stirrers gradually carry the unconsumed substance into the pit I, to be afterwards removed by a travelling conveyor or other desirable means.

Generating Water Gas.

STEPHENSON, J., of Hunslet, near Leeds.

No. 6849; March 18, 1911. No. 17,220; July 27, 1911.

In the manufacture of water gas, it is usual, the patentee mentions, to employ a generator containing coke, which is heated at intervals by an air-blast and through which steam is then passed—the steam being split up by the glowing coke to form water gas. And it has been proposed, in connection with certain types of generator, to provide mechanism to control the sequence of certain operations in an automatic manner. In that case the generator itself was combined with a regenerator or chamber containing grids or baffling surfaces intended to be heated by combustion gases; the heat thus stored being utilized subsequently to generate steam from water fed into the regenerator. In apparatus according to the present invention, there is no regenerator in the system; but steam is generated in a separate boiler, and is supplied to the generator when required. The periods and sequences of all the operations—including the supply of fuel and of the steam to the generator—are positively controlled by mechanism driven at constant speed, so that the whole working of the generator for producing the gas is accurately timed, and "practical uniformity of the product is thus secured." The operator has not to feed in fuel occasionally or to turn on water occasionally, but has only to see that the controlling

mechanism continues to work properly; so that one operator can superintend the working of several sets of apparatus if required.

Fig. 1 shows the generator in section, and illustrates all the principal parts of the apparatus. Fig. 2 shows, on a larger scale, the arrangement of valves and control apparatus at the side of the generator.

The generator has a hinged top piece or cover, so that it can be opened when required. A is a moving grate, which will automatically discharge the clinker and keep itself clear without attention. Above the generator is a flue or funnel B, leading upward to a steam generator C—"of any suitable construction," but the one indicated is a tubular boiler through which the hot gases will pass. This steam-generator is heated by the hot gases from the gas-generator while the air-blast continues; otherwise it is heated by gases burning in jets from a burner ring below. The funnel B has openings in it for the admission of air to ensure the complete combustion of the generator gases. At the side is a fuel hopper to which the coke is charged, and from which it is supplied at regular intervals to the generator by a rotating bucket device which discharges fuel at intervals in measured quantities into the shoot D, and thence through the flue B, into the generator when the cover is raised. The rotating bucket is turned, as hereinafter described, from a shaft which rotates at a definite speed, so that the charging takes place at the proper moment in the sequence of operations. There is a slide which can be used to close the funnel B when the blast through the generator is not taking place; the slide having openings in it which will permit just sufficient air to pass through in order to supply the air required to maintain the combustion of the gas at the burner ring below.

The whole apparatus is driven from one source of power by shafts, gearing, and so forth, "in order that all the various operations can be accurately timed to take place in their proper sequences." The speed of the shaft E may be assumed to be 120 revolutions per minute. The shaft drives, through a worm and a worm wheel, a second shaft F. The reduction in speed between the shafts may be made considerable through worm gearing, so that the shaft F can run at the rate of one revolution in 15 seconds—*i.e.*, four revolutions per minute. This shaft in turn drives, through another worm and worm wheel, a shaft G, which (say) makes one revolution in five minutes, and drives, through a chain or other gear, a shaft H running at the same speed, which, in turn, drives, through a chain or other gear, a shaft I making one revolution in fifteen minutes.

The principal parts of the apparatus are indicated in a more or less diagrammatic manner in fig. 1; and it will be convenient now, the patentee says, to refer to fig. 2, in which the details of the pipes and apparatus for controlling the flow of steam, air, and gases to and from the generator will be more clearly seen. J is a pipe bringing air from a compressor or storage reservoir. K is the cock which turns on the air-blast to the generator, and L is the blast-pipe leading into the generator below the grate A. M N are the gas outlet valves communicating with a branch pipe to take away the generated water gas to a storage reservoir or to the apparatus in which the gas is used. O

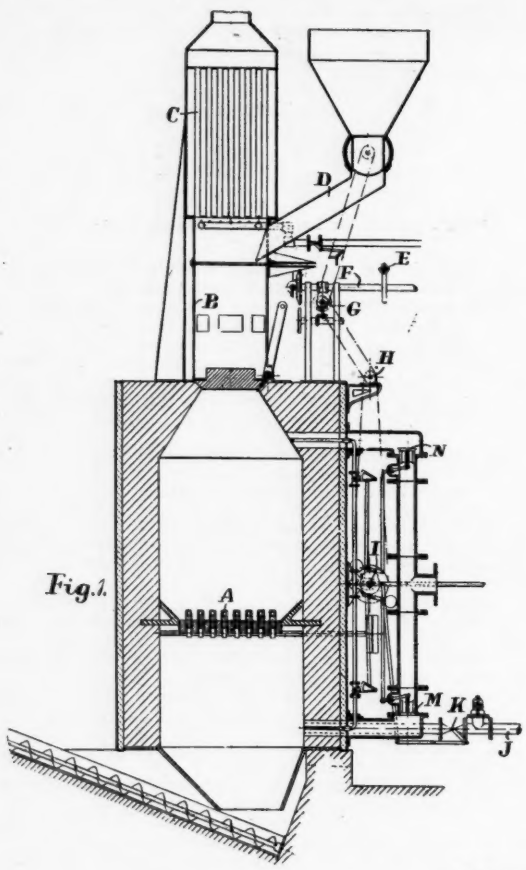


Fig. 1.

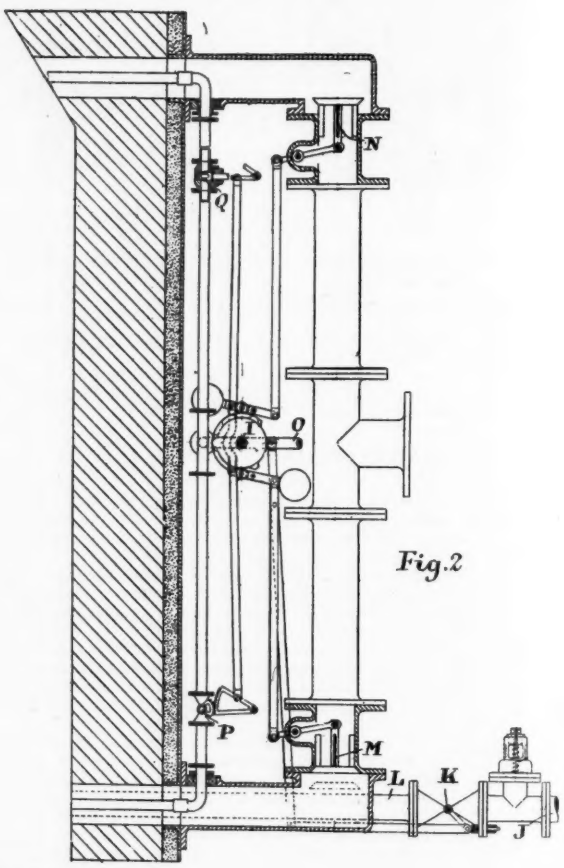


Fig. 2.

Stephenson's Water-Gas Generator.

is the steam admission pipe leading from the steam-generator and branching off into two pipes carried through the outlet pipes into the bottom and top of the generator respectively. The two cocks P Q are operated by toothed sectors connected to pivoted rocking levers, connected to rockers by which the outlet valves M N are operated. The rocking levers are counterweighted, and have rollers which work on cams on the shaft I.

After giving further minute details as to the working of this part of the plant, the specification proceeds to note the sequence of operations of the generator. Assuming it to be closed, the top cover may be raised, and at the same time the air-blast will be turned on by the valve K at the bottom of the generator; this being effected from the cam on the fifteen-minute shaft I. While the air-blast continues, the steam-generator C at the top is being heated by the hot gases; and a rocking catch arrangement, worked by a projection on the slide, has turned the valve so as to nearly cut off the gas from the burner ring. During the time that the cover is raised, the bucket attached to the hopper discharges a definite amount of fuel into the generator—the bucket afterwards continuing its rotation, taking in a fresh charge from the hopper, and not discharging this again until another five minutes have passed. At or near the end of the minute from the beginning of the air-blast, the blast is cut off by the cock K, as the roller runs down again on to the smooth part of the cam, and the cover of the generator is lowered again by the clutch arrangement already described. As the cover closes, the slide is also closed, and the gas is turned on again to the burner ring by a catch arrangement, so that the steam-generator continues to be heated. Next the appropriate cam causes the steam to be turned on at the cock P, and the outlet valve N to be opened. The steam-blast through the generator from bottom to top continues for about four minutes, after which the cock P and valve N are closed again, the cover of the generator is opened, and the air-blast is turned on as already described. During the next five minutes the same sequence of operations occurs. During the third period of five minutes, the same sequence of operations occurs again, except that the steam-blast is turned on at the top through the cock Q and the outlet valve M is opened, taking out the manufactured water gas from the lower end of the generator. After the fifteen minutes, the sequence of operations begins again as before.

It will be seen, therefore (the patentee states), that the same sequence of operations as is secured when working a generator by hand is effectively secured by the automatic mechanism; so that the best results can be obtained without any personal attention, except such as is required to supervise the working and to see that the machinery is running properly. One man can supervise the working of several water-gas generators operating as described, and the one set of shafts, cams, &c., might be adapted to move simultaneously, through suitable connections, the valves, cover, fuel and feeding apparatus, and so forth, of two or more generators arranged side by side.

Of course, the apparatus is not necessarily timed to operate exactly in the sequences or for the periods referred to. For instance, there may be an equal number of steam-blasts from the top and bottom respectively of the generator if preferred. Again, the air-blast might be continued sometimes for more than a minute, and the steam-blast during which the gas is generated might be continued for less than four minutes if a better quality of gas were required. The best quality of gas is always produced just after the air-blast, and the gas becomes

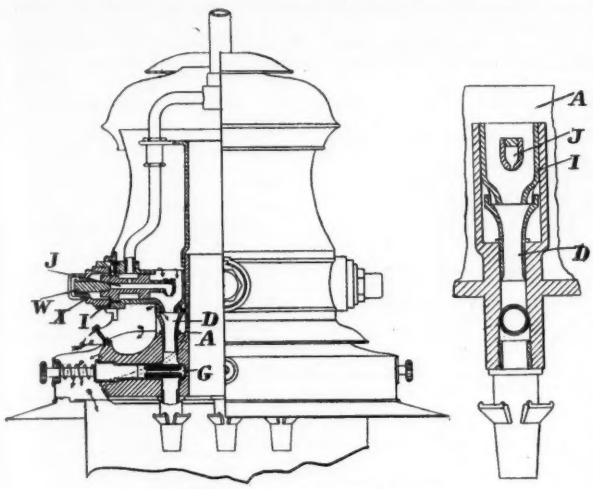
poorer as the generator cools down towards the end of the steam blast periods. The lengths of the projections of the cams can therefore be readily modified to vary the relative periods, or the timing of the shafts can be varied to change the total periods of the operations simultaneously.

Inverted Burner Lamps.

WORSFOLD, F. J., of East Dulwich.

No. 7515; March 25, 1911.

This invention has for its object "the construction of a lamp which shall, in combination with the burner as an integral part, afford an easier and more reliable means of adjusting the air and gas supplies, accessible from the outside of the lamp casing—such means to be free from any mechanical movements, toothed wheels, or gearing."



Worsfold's Inverted Burner Lamp.

The illustration shows a partial sectional elevation of the lamp, and a section of the combined regulating device and mixing gauze.

The cast-iron chimney A has a trumpet-shaped end with bosses on the upper and lower sides and a hole vertically through the bosses to receive the mixing-tube D at its upper side, and threaded on the under side to receive the burner-nozzle. There is a horizontal hole drilled through the projection formed by the boss pieces to receive the regulating and mixing device G. Vertical wings extend from the side of the upper boss for receiving the end of a metal sleeve I. This sleeve is provided with means for conveying the gas to the mixing-tube D in the form of a plug J, recessed out in the centre and drilled through to secure a passage for the gas to its interior. The front of the plug is fitted with a lengthening piece W, having a left-hand thread on one end and a projecting rim on the other, which is provided for the hollow plug X to turn against when unscrewing for the purpose of withdrawing the plug J from its seating.

In the detail, which is drawn to a larger scale, the adjusting device and mixing gauze G are shown in cross section. They are constructed preferably of brass or copper tube closed at one end; and lengthways of the tube two slots are cut—including a narrow bar between them—forming two-thirds of the circumference, the remaining third being left solid. Inside this chamber, gauze of suitable mesh is placed. The open end of the tube is then screwed to a metal plug, which, in its turn, fits the horizontal hole in the bosses and is carried through the outside casing. Suitable means, in the form of a spring and removable collar, are arranged to retain it in position when adjusted, and, further, to allow the mixing device to be rotated or removed at will. Thus, by the operation of rotating the regulating and mixing device G, the solid part can be brought round to reduce the area of the hole below the mixing-tube D to any required degree—at the same time leaving a full area of gauze on the outlet or under side boss for the combustible (which is now considerably expanded by preheating and mixing in the chamber) to fully escape to the point of ignition.

Coin-Freed Gas-Meters.

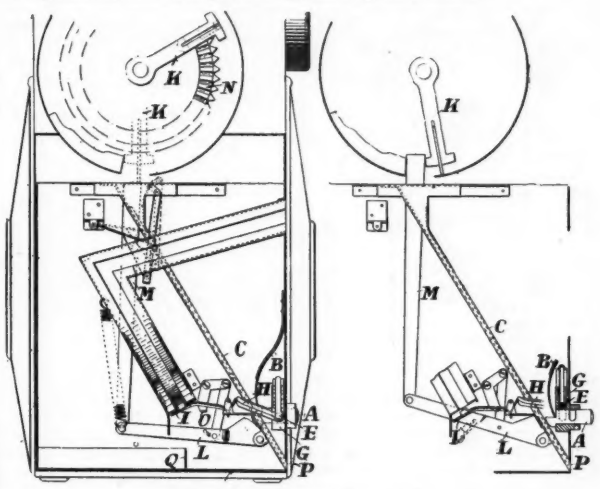
ATKINSON, C. W., of Great Missenden.

No. 7885; March 29, 1911. No. 20,817; Sept. 29, 1911.

This conjoined invention relates to that class of coin-freed gas-meters in which a coin of higher denomination is used to release a predetermined number of coins of a lower denomination "in order to reduce the amount of coin to be collected by the supplier of gas," and also in which the locking of the supply mechanism is effected against movement when the coin-change mechanism is being operated or is not in its normally set condition. The object of the invention is to simplify the mechanism described in patent No. 15,186 of 1908, and to render it practically proof against attempts to tamper with the meter for a felonious purpose short of the actual destruction of the device, and "further improvements in this mechanism whereby difficulties with regard to want of uniformity in the construction of meter mechanism and change-giving mechanism are entirely overcome, allowing for variations within a reasonable range, and also the delivery of the coin from the primary coin-carrier into the coin-shoot of the change-giving mechanism is made certain in its action in spite of any differences which may exist in the shape and size of coins of a particular denomination, due to wear, slight deformation, or other cause."

The illustration shows a sectional elevation of the coin-controlled apparatus with six coins inserted ready for release by the insertion of a coin of higher denomination; as also a similar view of the mechanism in the unset position, after the six coins have been delivered externally and the higher denominational coin has been deposited in the coin-receptacle after its function of control has been completed.

The knob A (pressed by the spring B) does not, under normal conditions, extend beyond the exterior of the meter sufficiently far to enable it to be caught hold of by any device. The internal part of the knob is adapted to traverse the primary coin-shoot C to prevent the delivery of coins of low denomination, and is held locked in this position by a detent, consisting of a pin or bar E, adapted to engage in a transverse slot in the knob so that the pin or bar is in shear with respect to the fixed parts G, against which it bears, and the walls of the slot in the knob which bear against it. The effect of this arrangement is that an enormous force must be exerted from an external source to withdraw the knob in its locked position by external means. This locking pin or bar E is loosely mounted on one end of a pivoted coin-lever H, having a receptacle I at the end of the lever opposite to the locking bar for catching the coin of higher denomination. The balance of the lever H is normally with a preponderance of weight at the locking bar end, so that the bar automatically drops into, and engages, the locking slot in the knob, and is held therein under the action of the spring. The knob is adapted to co-act with the "low denomination coin-carrier locking mechanism" K by a lever L and bolt M, so that when the knob is released from the retention of the locking bar E the mechanism K, or the supply mechanism N connected with it, is positively locked in position against any movement.



Atkinson's Coin-Freed Gas-Meter.

In conjunction with the knob is arranged a pivoted device O, which will engage with a projection on the receptacle I and support it with the coin of high denomination thereon, but which will disengage therefrom and release the balance lever H when the knob travels to its extreme outward position, and enables the lever H to complete its stroke of being overbalanced and opens the low denominational coin-shoot C, so that the low denominational coins are delivered externally to the device at P, and simultaneously the high denominational coin is dropped from the lever H into its receptacle Q in the body of the device.

When the device is to be set after a coin-changing function has been effected, the knob is pressed inwardly, so as to unlock the coin-carrier mechanism K, or the supply mechanism N connected with it, and the locking bar E of the lever H drops by its own weight into the slot of the knob. After, for example, six pennies have been inserted one by one into the coin-controlled mechanism, the last penny locks the coin-carrier K until the six coins have been exchanged for a sixpence inserted into the machine. On insertion of the sixpence, nothing happens until the knob is slightly pressed inwards, when the engagement of the knob, slot, and locking bar E is destroyed, and the lever H, by reason of the weight of the sixpence resting upon it, then overbalances, the locking bar E is withdrawn, and the lever rests upon the temporary retaining device O. On pressure being removed from the knob, it is forced outward by its spring simultaneously opening the low denominational coin-shoot C, allowing the pennies to drop out and withdrawing the temporary retaining device O from under the lever H, permitting the sixpence to be discharged from it. The mechanism K is locked during these operations, and is only unlocked when the mechanism is again reset for the next operation.

Heating and Ventilating Apparatus.

ILIFF, F., of Levenshulme, Manchester.

No. 24,606; Nov. 6, 1911.

This invention relates to a modification of the invention for heating and ventilating apparatus applicable to public halls, other buildings, and rooms, for which the patentee obtained a patent, No. 20,164, Aug. 30, 1910, which described an apparatus of the class which is arranged to deliver fresh heated air and to extract from the room or building foul air entering the apparatus near the floor level and discharge it outside.

The present modification consists in taking the foul air from the room through a series of gratings or openings in the floor by any "known method of extraction" and passing it beneath the floor up to, and through, a series of tubes, as well as through the space formed by an outer casing which it is now proposed to employ. Further, in the form of apparatus which is circular in cross section, instead of employing baffle-plates arranged in the form of a spiral, a series of semi-circular baffle-plates is employed, and in place of the small vertical pipes for the passage of the hot air into the collecting chamber two larger pipes are used.

Recovering as Ammonia the Volatile Nitrogen of Coal.

DOHERTY, H. L., of New York.

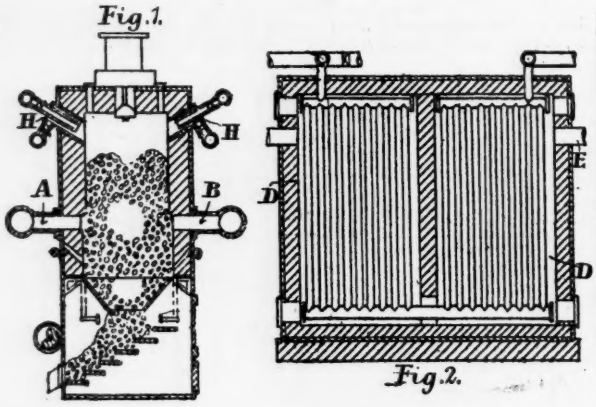
No. 11,383; May 11, 1911.

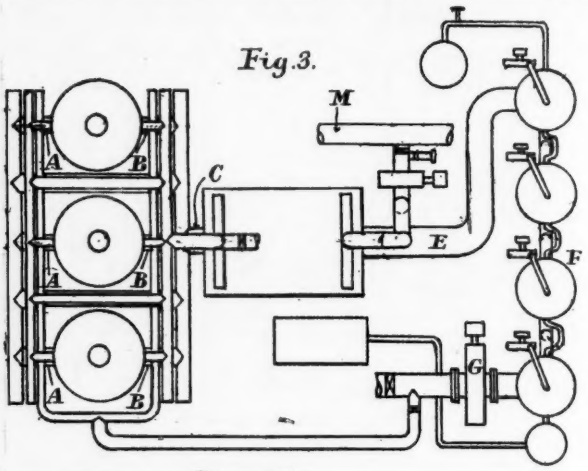
The object of this invention is "the conversion of the greatest practicable proportion of the volatile nitrogen of the coal to ammonia in the destructive distillation of coal, and its subsequent preservation in, and recovery from, the distillation gases."

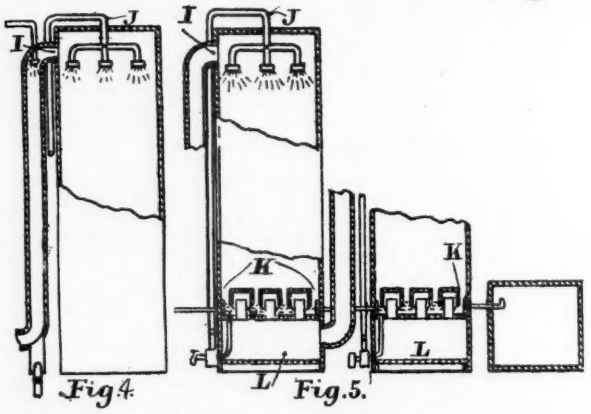
Fig. 1 is a vertical section through one of the carbonizing chambers. Fig. 2 is a similar section through the recuperator. Fig. 3 is a diagrammatic plan of the apparatus. Fig. 4 shows a section of the upper part of one of three towers, with a portion of the gas-pipe connecting two of them. Fig. 5 shows a part section through the last two towers showing one of the sprays, the liquid seals, overflows, &c.

In starting the apparatus, coarse cinder or coke is charged into the carbonizing chambers through the hoppers at top, until a bed has been built up in each chamber well above its hopper-bottom. A fire is then kindled on the bed, and coke is gradually charged through the hoppers until there has been built up in each chamber a bed of ignited coke to above the gas "off-takes" A, which connect with the "off-takes" B on the opposite side of the carbonizing chambers. These pipes join the main conduit C, and conduct the gas to the chamber D of the recuperator. The discharge conduit E from the recuperator connects with the tower of the absorption apparatus F. The last absorption tower is connected with the exhauster G. When the fire has been kindled in the carbonizing chambers, the blower is started at a low speed; and the doors of the chambers being open, air enters below the grates and passes up through the material resting on the grates, and sustains the combustion in the carbonizing chambers. The combustion gases are drawn off through A B and conducted to the recuperator through the gas-chambers and the passage E to the first absorption tower; thence, through the others and their connecting passages, to the exhauster and discharge.

Assuming that the apparatus is in a condition to start on the carbonization, coal is charged at intervals through the hoppers at top,







Doherty's Apparatus for the Recovery as Ammonia of the Volatile Nitrogen of Coal.

while the material at the bottom of the chambers, resting on the grates, is withdrawn in corresponding volume. The raw coal is, immediately upon its entrance to the chambers, subjected to the heat of the flame from burners H, which causes the destructive distillation of the volatile hydrocarbons of the coal. The products of the distillation and the gases from the burners pass downwards through the bed of fuel and thence leave the chambers through the "off-takes" of the several carbonizing chambers, passing to the recuperator by the pipes shown; thence, through the recuperator (where they are partially cooled by the air passing through the flues), through the conduit E, to the first tower of the absorption apparatus F. In passing through this, the gases are cooled, and the ammonia which they contain is absorbed by suitable liquid circulated through the towers.

The method of operating this absorption apparatus is as follows: The towers are each provided with a gas-inlet I, a spraying apparatus having a plurality of spraying caps connected to the pipe J, a liquid-sealing device K, and a gas outlet-chamber L. The sealing device consists of a false-bottom fastened water-tight into the absorption chamber and holding a small depth of liquid. Short vertical pipes are inserted in the false-bottom of the chamber and are covered by caps, supported on brackets attached to the pipes. These caps have a sufficiently large internal diameter to leave an annular space around the pipes at least equal in area to the cross section of the pipes. Under the influence of the suction of the exhauster, the gas enters at the top of the first tower, is loaded with spray from the spraying device, passes to the bottom of the tower, bubbles up through the liquid seal into the caps, thence passes down into the chamber L, thence to the next tower, and so on to the last one.

After giving other particulars as to the plant, the patentee remarks: It is apparent that this method of absorbing the ammonia ensures the most intimate contact possible between the gas and the liquid; the absorption of the ammonia being rapid and complete, and reducing the capacity necessary in the absorbing apparatus to a minimum.

In the destructive distillation of coal for the recovery of ammonia, there are two opposing considerations in regard to the temperature at which the distillation should be conducted. In the first place, since ammonia is appreciably dissociated in contact with carbon at even so low a temperature as 1100° Fahr., it is apparent that the temperature should be as low as other considerations will permit. On the other hand, in order to convert the volatile nitrogen of the coal into ammonia, it is absolutely necessary to heat the coal sufficiently high to break up the compounds in which the nitrogen is held in the coal. To secure the maximum possible initial formation of ammonia during the distillation, it has been found that the primary products of the distillation must be heated to about 1700° Fahr. In practical working, therefore, it is necessary to strike a balance between these two opposing considerations and endeavour to operate under such conditions as will give the maximum quantity of ammonia recovered—say, about 1500° Fahr.

While the raw coal may be exposed to the action of a flame of much higher temperature than that stated, owing to its low conductivity and the rapid carrying-off of the heat absorbed, in the distilled vapours, the high temperature cannot be allowed to extend so far into the mass of carbonizing coal as to heat the distilled products much above 1500° Fahr. without injuriously affecting the quantity of ammonia produced. Owing to the low conductivity of the coal and the coke formed from it, starting with a high temperature flame, the flame may penetrate to a considerable distance into the mass of material in the carbonizing chamber before its temperature has been reduced to 1500° Fahr. by the secondary reactions set up. The distillation products, therefore, would be exposed to an injuriously high temperature.

To meet this condition, the patentee proposes to modify the temperature of the flame in the carbonizing chambers by mixing with the air supplied to the burners sufficient stack or flue gases, or gases from the exhaust of an internal-combustion engine taken from the flue M, to reduce the temperature of the flame to a safe point. By properly adjusting the valves on the gas-pipe and air-intake respectively, any mixture of flue gas and air can be obtained. By this addition, the heat capacity of the gases is increased per unit of gas burned, by increasing the volume of the gases. Thus, the flame temperature is limited to the proper point; but it will still carry enough heat into the mass of coking coal to ensure a proper destructive distillation of the hydrocarbons and nitrogenous matter, with the formation of the maximum quantity of ammonia. Further, by thus increasing the normal volume of the gases, it is possible to correspondingly increase the velocity with which they pass through the mass of carbonizing coal in the chamber, and thus diminish the time during which the distilled vapours and gases are in contact with the hot coke.

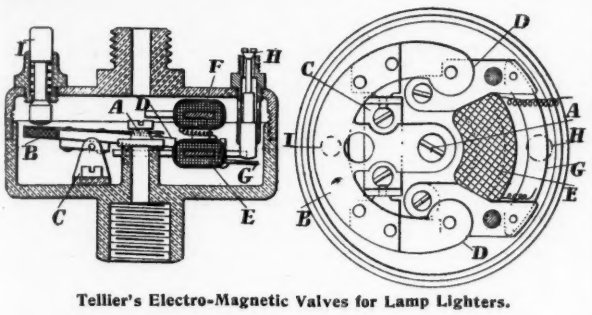
To further increase the yield of ammonia, it is proposed to pass through the still incandescent coke in the bottom of the carbonizing chambers the steam and gases produced in the quenching of the coke in the lowest part of the coke bed—*i.e.*, the part resting upon the grates and below the hopper-bottom of the carbonizing chambers. The water (sprayed on to the coke on the grates from spray-caps) is vaporized by the hot coke, and, rising up through the superincumbent layers of the unquenched coke, is partly dissociated into hydrogen, carbon dioxide, and carbon monoxide. The nascent hydrogen assists in the evolution of the final portion of the volatilizable nitrogen, as ammonia. In ordinary carbonization, the coke is said to retain, in some form not at present definitely known, a large proportion of the total nitrogen of the raw coal—usually about 50 per cent. By subjecting the hot coke, in the manner described, to the influence of an atmosphere rich in nascent hydrogen, one is able to convert into ammonia and recover a considerable part (about one-third) of this usually fixed nitrogen, and thus greatly increase the quantity of ammonia recovered.

Electro-Magnetic Valves for Gas Apparatus.

TELLIER, E., and the CIE ANONYME DES ALLUMEURS EXTINCTEURS DU GAZ À DISTANCE, SYSTÈME GOTÈ, of Bouchain (Nord), France.

No. 20,402; Sept. 14, 1911.

This valve is of the kind operated from a distance by a movable permanent magnet arranged in a gas-tight casing and directly operating a valve by tilting between two electro-magnets so as to maintain the valve automatically either in the open or closed position, according to the direction of the current sent momentarily through the electro-magnets.



Tellier's Electro-Magnetic Valves for Lamp Lighters.

The device comprises a cup on which can be screwed a cover enclosing the mechanism, which comprises a cap valve A supported by a spring plate and fixed on a permanent magnet B provided with trunnions by means of which it can rock on a fixed support C. The magnet is arranged in such a way as to be normally held in equilibrium on the support. Its polar enlargements D can rock between the corresponding enlargements of a lower electro-magnet E and those of an electro-magnet F arranged above the first, from which it is separated by blocks. The magnets are so wound that the current which traverses them creates poles of contrary direction in the corresponding enlargements.

This valve is adapted to be combined with an igniter of the type described in patent No. 11,301 of 1907. The core of the lower electrode is extended by secondary enlargements, which can attract a soft iron armature G so as to lift a cap H obturating the auxiliary gas-conduit feeding the carburettor of the igniter. A press button I is provided for tilting the magnet B by hand to open the valve in case of an interruption in the electric circuit.

The function of the valve A can be easily understood. If an initial passage of the current draws the magnet B into the closed position shown, it is evident that a second passage of the current in a contrary direction will cause the magnet to rock towards the terminals of the magnet F, and, consequently, cause the opening of the valve—the magnet B closing the circuit on the magnet F. The arrangement of the parts is such that, when the valve is closed, the plate supporting the valve A forms a light spring applying the valve more forcibly on its seat to assure gas tightness.

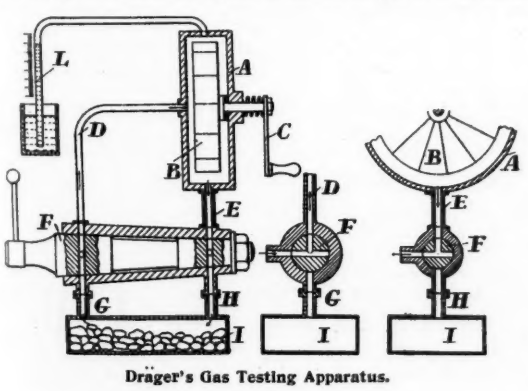
It is to be noted that the balancing of the permanent magnet B allows of neutralizing the effect of vibrations and inertia which would tend to affect the position of this magnet. The apparatus can be employed as shown, or reversed. In the latter case, the valve H must be arranged on the cup and the armature G above the enlargement, instead of below it. To prevent the adherence of the magnet and the corresponding enlargements, the latter or the magnet is provided with non-magnetic spacing abutments.

Apparatus for Testing Gas.

DRÄGERWERK, HEINR. AND BERNH. DRÄGER, of Lübeck, Germany.

No. 24,654; Nov. 6, 1911. Date claimed under International Convention, Nov. 5, 1910.

The patentees remark that, to test gas mixtures of which the quantities of the constituent gases—for instance, carbon monoxide, carbonic acid, or oxygen—are to be determined, it is usual to lead a confined sample of gas to a medium adapted to absorb the gas to be tested and



Dräger's Gas Testing Apparatus.

to measure the vacuum created by the gas thus absorbed. But the apparatus heretofore proposed for the purpose possesses the disadvantage that it is not convenient, and that the sealing liquids used can easily overflow.

According to the present invention, the apparatus essentially consists of a fan or blower arranged in a casing communicating with an absorption chamber by two pipes and a multiple-way cock, in such manner that, according to the position of the cock, the fan communicates alternately with the outer space or the absorption material, and that the sample of gas is driven through the apparatus in a circle.

Within the casing A a centrifugal blower or fan B is arranged, the shaft of which is journalled in the wall of the casing and provided with a crank C. By rotating the fan a vacuum is created in a pipe D branching off from the centre of the casing; and air pressure is created in the pipe E branching off from the peripheral part of the casing. Both pipes D and E lead to a three-way cock F. According to the position of the cock, communication of the pipes (and therefore of the inner part of the fan also) is established with the outer space, and so a thorough change of gas in the casing is ensured. From the cock two pipes G H lead to a closed chamber I, filled (or partly filled) with a material suitable for absorbing the gas to be tested.

When the change of gas has occurred, the cock is turned into such a position that the outer space is shut off and a connection is effected between the fan-chamber and the absorption material. When the crank C is again operated, a circulation of the enclosed gases takes place through the casing and the absorption chamber in the direction of the arrows, whereby, on the repeated contact of the gases with the absorption material, the latter absorbs all gas (such as carbonic acid, carbon monoxide, or oxygen) whose volume or quantity is to be determined. The reduction of the gas creates a corresponding vacuum, the degree of which can be determined by any suitable construction of vacuum gauge—for instance, by a column of liquid L in a pipe communicating with the interior of the fan casing.

Manufacture of Gas from Coal.

ROLLASON, A., of Long Eaton, Derbyshire.

No. 18,744; Aug. 21, 1911.

This invention relates to a process in which lime is mixed with coal before charging the retort, "with a view to reduce the need for so high a temperature in the retort, and the period required for carbonizing the coal, also to improve the quality of the coke."

Some classes of coals (the patentee remarks), which are high in ash, containing a large percentage of silica, require a very high temperature—approximately between 1050° and 1150° C.—in the retort, and a long period of carbonizing before all the gases are driven off; the coke produced being very dense, and almost unsuitable for domestic purposes. Other coals, which contain a high percentage of alumina, give off their gases at the commencement of carbonizing; the coke produced from such coals being soft, friable, dusty, and of low specific gravity. His proposal is "to subject the coals, during the process of carbonizing, to a treatment which renders the silica and basic substances contained in the coal fusible at a lower temperature, and allows the gases to be given off, either at an increased rate in the case of high silica coals, or during a prolonged period in the case of high alumina coals, and to produce, in either case, an improved quality of coke."

In carrying out the invention,* the coal is first crushed below ¼-inch diameter. To the crushed coal is added a percentage of finely-ground lime, limestone, or other basic substance, varying according to the quantity of silica and basic substances contained in the particular coal to be carbonized. Sufficient lime or limestone is added, in conjunction with the basic substances already in the coal, to transform the silica of the ash constituents of the particular coal used into a neutral silicate, according to the formula SiO_2CaO, consisting of one molecule of silica and one molecule of basic substances (approximately).

In cases where the ash in the coal is low, to produce a dense coke, an additional quantity of silica, with a corresponding amount of basic substances, may be added beyond the basic substances required to form a neutral silicate—"for the purpose of increasing the fusible, binding material of the ash."

The inventor states that he is aware that finely-ground lime, mixed intimately with coal in regulated quantities of from 1 to 2½ per cent., and in quantities of from 4 to 5 per cent., has been employed to neutralize the injurious effects of silica and to produce a hard coke; "but in all cases the lime has not been used in the proportion required according to the contents of the silica, magnesia, lime, &c., contained in the coal to form a neutral silicate of the formula (SiO_2CaO). As an example, he instances two samples of coal ordinarily used for carbonizing. An analysis of their ash gave the following particulars:—

		A.	B.
Ash in coal.		8·00 per cent.	8·00 per cent.
In ash were:	Silica. . . .	63·00 ,,	42·00 ,,
	Lime. . . .	8·25 ,,	14·50 ,,
	Magnesia .	4·50 ,,	8·50 ,,
	Alumina. .	6·00 ,,	12·00 ,,
	Iron oxide .	18·25 ,,	23·00 ,,

Such a coal as A requires a high temperature in the retort—approximately between 1000° and 1150° C., and carbonizing for a long period, before the silica and basic substances (lime and magnesia) fuse; the gases being retained until fusion takes place. The percentage of silica contained in the coal is, in this case, 5·04 per cent.; the basic substances (lime and magnesia) 1·02 per cent. To this coal, 3·54 per cent. of lime is required to be added to form a neutral silicate (SiO_2CaO), which will be readily fusible at a lower temperature—approximately between 850° and 950° C. The gases will be given off more rapidly at an earlier period of carbonizing; thus saving time and fuel. The addition of lime to the coal will produce a coke of less density and better quality.

Such a coal as B, on account of the high percentage of alumina in the coal, allows the gases to be given off more rapidly at the earlier portion of the carbonizing period. The high percentage of alumina in the coal produces a coke which is soft, friable, dusty, and of low specific gravity. The percentage of silica contained in the coal is, in this case, 3·36 per cent.; the basic substances (lime and magnesia),

* There are no drawings attached to the specification.

1·84 per cent. To this coal 1·01 per cent. of lime is required to be added to form a neutral silicate (SiO_2CaO), or its equivalent in limestone ($CaCO_3$), 1·81 per cent. Limestone should be added to this coal, to delay the fusion of the silica and basic substances, and retard the evolution of the gases at the commencement of the carbonizing period, to produce a hard and dense coke, which is free from dust. The neutral silicate formed by the addition of limestone will, after the carbonic acid has been given off, be readily fusible at a lower temperature; and the coal will require a shorter period for carbonizing.

For calculating the correct percentages of lime or limestone to be added to the coal, it will be necessary to know the composition of the coal ash, which will have to be determined by an exact analysis of each coal.

It is important, he remarks in conclusion, that the temperature of the retort should be sufficiently high—between 850° and 950° C.—to allow the silica and basic substances to combine and form a liquid slag to bind the carbon.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF COMMONS.

The following further progress has been made with Bills:—

Bills read a second time and committed: Leatherhead Gas Bill [Lords], Sidmouth Urban District Council Bill [Lords], Swansea Corporation Bill, Tendring Hundred Water and Gas Bill [Lords].

Bill read the third time and passed: Annfield Plain and District Gas Bill.

A petition against the Tendring Hundred Water and Gas Bill [Lords] has been presented by the Harwich Corporation; and the Wolstanton United Urban District Council have withdrawn theirs against the Staffordshire Potteries Water Bill.

Lord Robert Cecil has given notice of his intention to ask the Prime Minister to-day whether he has received a memorial, signed by 293 members of the House, asking for the appointment of a Royal Commission on Co-Partnership; and, if so, what decision the Government have come to on the point.

A Bill has been introduced by Mr. Harmood-Banner to remove doubts as to the legality of certain payments by the Councils of Metropolitan Boroughs. It consists of only three clauses; the first being as follows: "The Council of any Metropolitan Borough may, out of the general rate, pay reasonable subscriptions, whether annually or otherwise, to the funds of any association formed for the purpose of watching over and protecting their interests, rights, and privileges, or the interests, rights, and privileges of municipal corporations, and any reasonable expenses of the attendance of any members or officers of the Council, not exceeding in any case four, at meetings of such associations, and of purchasing reports of the proceedings of such associations." These provisions are to apply to any payment made by any Metropolitan Borough Council since April 1, 1910, and before the passing of the Bill.

ELECTRIC WIRING AND SUPPLY POWERS.

The Gaslight and Coke Company and the West Ham Bill.

Before the Court of Referees last Thursday, the Gaslight and Coke Company applied for *locus standi* to appear against the West Ham Corporation Bill (which deals, among other things, with electric traction and electricity supply), when it reaches the Committee stage.

Mr. G. J. Talbot, K.C., who appeared for the Company, pointed out that they supplied gas throughout the borough of West Ham, and also in the districts of Wanstead and Leyton, which latter were involved in his application. The Bill, an omnibus measure, consisted of ten parts dealing (*inter alia*) with tramways and electricity supply; and it was in respect of these that the application for permission to oppose was made. The first point was in regard to the tramway proposals. The Bill sought powers to construct tramways and run trolley omnibuses in the Wanstead and Leyton districts outside the borough of West Ham; and notice had been served upon the Gas Company of interference with their mains. As a matter of fact, the notice was so worded as to suggest that the West Ham Corporation intended to acquire all the Company's mains on the routes of the proposed tramways. He claimed a landowner's *locus* to appear against the Bill on this account, and quoted precedents to show that the mere notice to acquire land upon which a telephone pole stood had been held to give the National Telephone Company such *locus*. A notice to acquire land in which gas-mains were laid offered, he contended, a stronger case for the right to a landowner's *locus*. In existing Acts relating to West Ham, the Gaslight and Coke Company were given protection; but none was afforded in the present case.

After some argument, in which Mr. Balfour Browne, K.C., for the West Ham Corporation, stated that it was not the intention to acquire an inch of the Company's mains, but merely to alter or remove them for the purposes of the tramways [Mr. Talbot's case was that the Company should have the right to make any such alterations and charge the Corporation with the cost],

The Chairman (Mr. Whitley) said the Committee would disallow the Company's application for *locus* in respect of their mains provided the promoters inserted in the Bill the same protective clauses relating to the Gas Company as were in the existing Acts.

Mr. Balfour Browne agreed.

Mr. Talbot then applied for *locus standi* on the ground of general competition in respect of Part VII. of the Bill. This relates to the West Ham Corporation electricity undertaking. Clause 64 gives them power to supply electricity in bulk to the Wanstead Urban District Council, and clause 65 power to supply in detail to individual consumers in Wanstead. Clauses 67 and 68 gave unprecedented powers to the West Ham Corporation in respect of their electricity undertaking. They were as follows:—

Clause 67.

(1) The Corporation may enter into, and carry into effect, agreements or arrangements with any consumers, or intending consumers, of electrical energy supplied by them for the supply of such energy to such consumers, or intending consumers, and also, if so agreed between the Corporation and any such consumers or intending consumers, for the provision and installation of wires, meters, fittings, engines, machinery, apparatus, and appliances of any description for which electrical energy can be used, or which can be used in connection with, or incidental to, any purpose connected with the use of electrical energy, upon payment of a fixed periodical sum.

(2) The Corporation may, subject to, and in accordance with, the terms of any such agreements as aforesaid, maintain, repair, alter, and remove any wires, meters, fittings, engines, machinery, apparatus, or appliances provided or installed by them under such agreement, and make and recover charges for such maintenance, repair, alteration, or removal.

(3) The Corporation may formulate, and from time to time revoke, alter, amend, or extend, and may give effect to, any scheme or schemes for, or in connection with, the purposes aforesaid, or any of them, and may by any such scheme prescribe the terms and conditions upon the subject to which effect may be given to the purposes aforesaid, or any of them.

(4) The Corporation may, in lieu of themselves entering into any such agreements or arrangements as are referred to in this section, make such agreements and arrangements as they may think fit with any company, body, or person for the supply (upon such terms as are hereinbefore referred to) to any such consumers or intending consumers as aforesaid of electrical energy supplied by the Corporation, and the provision and installation of any such wires, meters, fittings, engines, machinery, apparatus, and appliances as aforesaid, and may, for the purposes of any such agreements or arrangements as are authorized by this sub-section, make to any such company, body, or person such payments (if any) as may be agreed in respect thereof or in connection therewith.

Clause 68.

In addition to the powers conferred upon the Corporation by the section of this Act, of which the marginal note is "Supply at Fixed Price" (clause 67), the Corporation may formulate, and from time to time revoke, alter, amend, or extend, and may give effect to, any scheme or schemes for the supply of electrical energy, and the provision, installation, maintenance, repair, alteration, and removal of wires, meters, fittings, engines, machinery, apparatus, and appliances, and with respect to the price or rate to be charged therefor and the mode or basis of charging the same.

The section of the Bill introduced an absolutely new sort of competition with the Gas Company; and for this reason he was entitled to general *locus* to appear against it. It was proposed to go outside the borough to supply electricity; and under clause 22 of the Bill powers were also taken to light by electricity all the roads traversed by the new tramways. These roads were at present, for the most part, lighted by gas supplied by the Gas Company. But even this power to light streets outside the borough was far exceeded by clauses 67 and 68, which gave authority to enter into exceptional agreements with regard to the supply of electricity, and also fittings, with any consumer. It was the contention of the Gas Company that such powers should not be granted, or, if they were, words should be inserted which would prevent any loss from such agreements falling upon the rates—in other words, the "Bermondsey" or "Northumberland" clause. At present, the Gaslight and Coke Company paid in West Ham rates amounting to £31,000 per annum, and were at the same time in direct competition with the Corporation Electricity Department. Clauses 67 and 68 were in an unprecedented form; and although the Corporation at present had powers to deal in electric fittings, the proposed clauses could be applied in all sorts of illegitimate ways.

The Chairman: Do you really resist *locus* on this part of the Bill, Mr. Balfour Browne?

Mr. Balfour Browne: Certainly.

Lord Robert Cecil: Was the "Bermondsey" clause put in at the instance of a gas company?

Mr. Balfour Browne: Yes.

Lord Robert Cecil: If this restriction was put forward for the benefit of gas companies, it may be that these clauses may take away the protection which Parliament deliberately put in. If this is so, there seems to be some ground for Mr. Talbot's application.

Mr. Balfour Browne said the Bill was not altering the present position in any way.

Mr. Talbot urged that he was entitled to ask for the insertion of the Model Clause relating to the supply of electric fittings, &c., and also the "Bermondsey" clause.

Mr. Balfour Browne, in reply, said the Bill gave the West Ham Corporation authority to light the roads in Wanstead and Leyton where the new tramways would be laid; and the local authorities in these districts were free to employ whom they pleased to do the work. He claimed a right to do this; but he agreed that the proposal to supply to individual consumers in Wanstead might give the Gas Company *locus* against the Bill in this respect—in fact, he would concede *locus* as against clause 65. He, however, strongly resisted *locus* in respect of clauses 67 and 68. These were merely domestic matters, which did not affect the Gas Company at all. They gave no new powers, but only modified the method by which the Electricity Department could be paid.

The Chairman said the Committee would grant the Gas Company *locus standi* to appear against the Bill in respect of Part VII., and also clause 22. On the ground of competition, the Committee thought the Gas Company should be heard.

LEGAL INTELLIGENCE.

WATER SUPPLY FOR WORKHOUSES.

SUPREME COURT OF JUDICATURE—COURT OF APPEAL.

Monday, April 1.

(*Before the* MASTER OF THE ROLLS *and Lord Justice* BUCKLEY.)

Bristol Guardians v. Bristol Water-Works Company.

Judgment was delivered last week in this case, which was an appeal from a decision by Mr. Justice Eve. The arguments were reported in the "JOURNAL" for the 12th ult. (p. 739).

The MASTER OF THE ROLLS said the case depended on the effect of certain Local Acts of Parliament, the language of which was so expressed as to be almost unintelligible. The plaintiffs claimed to be supplied with water for their workhouses for domestic purposes, at the rate specified in clause 68 of the Bristol Water-Works Act, 1862, to be charged for the supply to "private dwelling-houses;" while defendants denied the plaintiffs' right to make such a claim, and asserted that the Company were only bound to supply any premises other than private dwelling-houses, whether for domestic or non-domestic purposes at rates to be fixed by agreement. In the present case, this had been done for many years; the rate being 1s. per 1000 gallons. His Lordship went through the various Acts of Parliament in question, including the Water-Works Clauses Act of 1847, on the provisions of which the appellants mainly rested their contention; and he came to the conclusion that the only person who could claim a supply for domestic purposes was the owner or occupier of a private dwelling-house. He pointed out that if the word "private" were disregarded, and all premises in which any water was required for domestic purposes were to be charged a rate based on the annual value, it would bear very hardly on occupiers of factories and large business premises, and would throw an enormous burden upon many of the inhabitants of Bristol. He could not see how a workhouse could properly be called a private dwelling-house. He was therefore of the opinion that the decision of Mr. Justice Eve was right, and that the appeal must be dismissed, with costs.

Lord Justice FLETCHER MOULTON had written an elaborate judgment, which (in his absence) was read by Lord Justice Buckley. He said the question raised was evidently of great importance, and involved the principles of construction to be applied to all water companies and other public undertakings of the same type. He then considered in detail the Act of 1847, the provisions of which were to be incorporated into all subsequent Local Water Acts (unless specially varied or excepted), with the object of securing to the public certain rights and advantages in exchange for the powers and privileges granted to the undertakers. All such Local Acts were in the nature of a contract between the promoters and Parliament; and if, by mistake, anything were omitted which bore hardly upon the undertakers, it was they who were to blame, and the matter could only be set right by an amending Act. Examining in great detail the various sections in the Bristol Water Company's Acts, his Lordship came to the conclusion that every owner or occupier of a dwelling-house within their limits was entitled to claim a supply of water for domestic purposes on paying or tendering the rate specified in the Act; and he took it that this meant "the rate, if any," specified in the Local Act. In this case, the charging section (68) of the Act of 1862 only applied to "private dwelling-houses;" and there was therefore no power to charge. In consequence, the plaintiffs were, in his opinion, entitled to demand a supply for purely domestic purposes gratis. They were willing, and had offered, to pay on the same terms as if they were the occupiers of a private dwelling-house; and he was therefore of opinion that they were entitled to the declaration they asked for, and to have judgment in the action, with costs—the defendants having wrongfully refused to supply them on these terms.

Lord Justice BUCKLEY then read his own judgment, which agreed with that of the Master of the Rolls, and followed a similar line of reasoning.

The majority of the Court being against the appellants, the appeal was dismissed, with costs.

Local Authorities' Expenses in Promoting Legislation.

In the Court of Session, last Tuesday, Lord Cullen delivered two judgments in connection with the proceedings of local authorities, which have created considerable interest in municipal circles. The Corporation of Falkirk made application to the Secretary for Scotland last year, under the Private Legislation Procedure (Scotland) Act, 1899, for a Provisional Order to sanction a large extension of the boundaries of the burgh, and the transfer of the power and undertaking of the Falkirk and Larbert Water Trust. The application was opposed, and, after an inquiry, rejected. The expenses incurred by the Corporation were upwards of £4000; and the legality of providing this amount out of the general assessment was challenged by the Stirlingshire County Council, the Carron Company, and owners of property and ratepayers within the Burgh of Falkirk. His Lordship upheld the plea of the Corporation that their proceedings were legal, and dismissed the action. On the same day, his Lordship decided to a similar effect in connection with the promotion of the unsuccessful Bill promoted by the Aberdeen Corporation in 1910 for the purpose of obtaining a supply of water from the River Avon, and held that the Corporation were legally entitled to orders for the costs. It is understood that an appeal will be lodged in regard to the Falkirk case.

The Cheadle and Gatley District Council have accepted the offer of the Tar Roads Syndicate for the tar-spraying work required in the district up to March 31, 1913, at 1¼d. per superficial yard.

MISCELLANEOUS NEWS.

BOMBAY GAS COMPANY, LIMITED.

Expansion All Round.

The Annual Meeting of the Company was held last Thursday, at the London Offices, Moorgate Station Chambers, E.C.—Mr. H. E. JONES in the chair.

The SECRETARY (Mr. A. Dickson, jun.) read the notice convening the meeting; and the Directors' report and the statement of accounts were taken as read.

The CHAIRMAN, in moving their adoption, said the most important part of the report to the shareholders was the question of the dividend. Going straight to this interesting point, it would be seen that the Directors recommended a dividend of 7½ per cent. for the year, which was an advance upon that of 1910. But the Board were taking some of this back from the shareholders, because they had for a long time felt that the practice of the Company paying the income-tax direct in addition to the dividend was one that did not do the Company's shares justice on the Stock Exchange. A man who went to his stockbroker to buy some of the Company's shares perhaps did not know, and the stockbroker seldom knew, that this particular Company paid the income-tax for the shareholder; and therefore the Company's shares did not get the advantage that they would do if the income-tax payment were put in the shape of dividend and then deducted. He thought this fact would enable the shareholders to cordially endorse the recommendations of the Directors, who had resolved to ask them to adopt this particular recommendation. He thought that Mr. Richards, Mr. Oke, as well as Mr. Sibson would agree with him that what happened in connection with transactions on the Stock Exchange was that hardly any broker knew the particular private circumstances of the Company—that it did pay the dividend 1ree of income-tax. The advance in the dividend did not mean any great improvement, but it left net what would not be possible if it were not for another fact mentioned by the report, that the Company had an increase of 9·2 per cent. in the consumption of gas. This followed increases at even a larger rate, which might be exceeded in the future owing to the important extensions and developments that were being made in Bombay. This was the reason the Board informed the shareholders that it would be necessary before long to issue more capital. In the past year, they had added to the capital the sum of £20,398, which amounted to 8 per cent. upon the original standing capital. This was a safe addition for them to make, seeing that they sold 9·2 per cent. more gas than in the year before. Obviously, if they increased their business while they were increasing the capital, they added to the solvency of the concern. But in spending the money, they were nearly doubling the power of manufacturing gas on the works. They had increased the capacity of the retort-houses by 50 per cent. They had also installed a Kramer and Aarts water-gas plant, which would be useful in such an emergency as they had been going through in this country owing to the coal strike. They had now doubled the purifying plant; and they were at the present moment adding 50 per cent. to the capacity of one of the gasholders, part of which was paid for, but was not in the present accounts. Therefore, the shareholders would see that, although the Directors were increasing the capital, the dividend that was recommended was on safe lines. In arriving at this dividend, very great care had been paid to the essential feature of seeing to the upkeep of the works and plant generally, because, as everybody was aware who knew anything of gas-works, if they were loose in regard to the capital, a heavy burden was placed upon progress. He could assure them the members of the Board were not careless in seeing to this, with a capital equal to £1284 per million cubic feet. Those who were acquainted with gas undertakings were aware that he preferred a capital of £400 to £500, if it was possible to get such a figure. But that was in England, not in Bombay. Therefore the shareholders would see that, while it was important the Directors should add to the capital, it was also their duty to see that the wear and tear should be kept up—not to the relief of capital, but to the avoidance of what had happened to some companies who had carried dividend to capital, and then had had to ask Parliament to wipe it off from capital. The Directors of the Bombay Company would not have to ask for authority to do this. When he told those of the shareholders who were technically versed in gas affairs that, in regard to repairs and renewals, the Board had charged in the year's account no less a figure than 1s. 9d. per 1000 cubic feet, he thought they would see the Directors had done very well in protecting the capital from any invasion of the revenue account by dividing profits that had not been fully earned. This being so, there could not be a shadow of question as to the propriety of paying the dividend. Probably some of them would desire to know how the Company stood in regard to the coal strike. They were no longer dependent upon such an extremely uncertain factor as the supply of coal from England, because they now obtained their coals largely in India. It was plainly their duty to, and it was desirable that they should, make use of the assets of the country in which they supplied gas. Therefore, they had been using as much Indian coal as they could with advantage. They could not employ all Indian coal. The coke from it was not so good as they would like it to be; and the quality of the gas was not so good as they desired it to be. But they obtained from Australia an excellent supply of coal; and this was partly responsible for the dividends they had shown, coupled with the fact (which he hoped would be borne in mind) that, during the past four or five years, they had reduced the price of gas by 1s. 4d. per 1000 cubic feet. A reduction of 1s. 4d. in the price of gas might seem enormous when compared with the custom in this country. They had not reduced the price all at once by 1s. 4d., but by two instalments. The last 8d. did not appear in the present accounts, except three-fourths of it. With this reduction of 1s. 4d., he believed the increase in the sale of gas would continue on a high scale; and with such increases as 9·2 per cent., this meant doubling the sale of gas in as short a period as eight years. If they doubled their business in eight years, they must—he would not

say double the capital, but they must go a long way in this direction during the period named. These were some of the features in the account which seemed to him it was good for the shareholders to know and consider. The Board believed there was a great future for gas in the direction of fuel. Gaseous fuel was his hobby; it was hardly ever off his lips at meetings of shareholders. This had been the case ever since he read a paper about ten years ago before the Institution of Gas Engineers. To some extent he was laughed at at the time, as not all in the gas industry then believed gas undertakings were going to be the fuel suppliers of the future. If they were going to supply fuel, then it must be cheap. It was no use supplying for fuel a fancy article at a fancy price. Not only were the Directors developing business in Bombay on the lines ordinarily approved in this country, but what was of great importance to the Company was the carrying out to completion an enormous scheme for reclaiming a large area from the sea, and developing the docks, the trade of which was growing at a very great rate. The Directors were going further; and they were introducing some of the modern uses of gas, as practised in Europe, for domestic and trade purposes, which were doing so much in this country in placing gas on a still higher plane of success and prosperity. It would have been seen from the report that some capital was issued during the past year; and the issue was very successful in the way it was taken up by the shareholders. The Directors offered the shares by tender at a minimum price; and they were proposing to take the same course in the future. As a matter of fact, the Company were rather a "close borough;" and if their own shareholders were desirous of finding new capital, the Board thought it right to let them do so. If the Board failed in placing it among the shareholders, then they would fall back upon their friend Mr. Richards. The remainder of the capital they would offer by tender was somewhere in the region of £20,000. He regretted to say that one of their officers had come back from India rather broken in health; and they had had to send out another clerk to look after the rental department. They hoped that the officer who had returned home would now enjoy better health. There was only one other matter to which he had to refer. Their Articles of Association were now rather inadequate, and contained several blots. The Articles were fifty years old; and the Company had doubled their business in the last eight or nine years. One defect of these ancient Articles was that they did not contain provision for a sufficient emolument for the Directors. [Laughter.] He thought the Directors would call the shareholders together not far hence, in order to authorize the revision of the Articles. He moved the adoption of the report and accounts; and the declaration of a dividend of 4½ per cent. (less income-tax), making 7½ per cent. for the year.

The Deputy-Chairman (Mr. W. G. Bradshaw) seconded the motion.

Mr. A. W. Oke remarked that reference had been made by the Chairman to the question of the payment of income-tax. Although he (Mr. Oke) admitted that the new arrangement might tend to increase the price of the shares on the market, he would point out, on behalf of those shareholders who were in the unfortunate position of having to obtain the return of the income-tax in whole or in part, that, in the case of companies like this, where the practice had been to pay the dividends free of income-tax, the change robbed them of what they had been receiving in the nature of a bonus—by way of money——

The Deputy-Chairman: You can get it back; it is only a question of making application for the money.

Mr. Oke: In the case of those who were entitled to the return of income-tax, they got it back when the Company paid it. When the dividends were paid free of income-tax, these shareholders not only received the dividend from the Company, but, the Company having in its benevolence paid the income-tax, they also got that back, so that actually these shareholders received it twice over.

The Deputy-Chairman: They ought not to have done so.

Mr. Oke admitted the shareholders were now getting 1s. 10d. extra; and in the case of those who were unfortunate or fortunate enough not to obtain any remission of taxation, the payment of the income-tax would bring home to them that the tax had got very high. His principal reason for rising was that in December he spent two or three weeks in Bombay; and he took the opportunity of visiting the Company's excellent show-rooms and offices in one of the best streets in Bombay. He was pleased with all he saw there. He also visited their Engineer (Mr. A. R. Burch), who had just returned from England. He obtained permission to go with him over the works; and he (Mr. Oke) took with him a friend who was an engineer, who was also well acquainted with the conditions of Bombay. They were extremely pleased with what they saw. They felt that, if they wanted to see some of the most up-to-date gas-works plant, they might very well look round the Bombay Gas-Works. Every care seemed to be exercised to ensure that the employees worked under the most satisfactory conditions; and it was evident they were being treated with every consideration possible. He was in Bombay when the King and Queen passed through; and he might say that he had never seen finer illuminations in any city that he had visited than those exhibited by the Bombay Gas Company. To his mind, they were far superior to anything else of the kind, having regard to cost. These were points that it was pleasant for him to dwell upon, because he felt that all concerned in the management of the Company were doing their best to promote its prosperity. The Chairman had referred to the extension of the docks, and to the reclamation of land there. So far as he (Mr. Oke) could see, Bombay was going to be a still more important city; and it was going to offer a splendid field for the Company's operations.

Mr. H. Reginald Sibson, referring to the changed conditions in the payment of the dividend, said the increase in the dividend, as he worked it out, amounted approximately for the past year to about $7\frac{11}{39}$; if they were only going to pay 7½ per cent. during next year, it would amount to $7\frac{1}{16}$, which would more than cover any difference on loss of income-tax. The shareholders, however, were hopeful that the Directors might be able to give them an increase upon the dividend they were paying this time, so as to make things still better. To him, too, the make and sale of gas per ton of coal were perfectly astounding; and this was evidence of the great attention paid to the business by both the Directors and the officers in Bombay. There was not the slightest question the Company were in a very satisfactory position. They had certainly a very able Board; and a singularly energetic Manager and Engineer, an excellent Secretary, and a loyal and industrious staff. They had an expanding revenue; and every prospect in the expansion of Bombay. They were largely increasing their business; so that he had not the slightest doubt the shareholders had a valuable investment. But, of course, as the Chairman had explained from time to time, the Company had had to make up considerable leeway, and had had to incur considerable expenditure. But they had the satisfaction of knowing that their works, distributing plant, and fittings were absolutely up to date. Taking all things into consideration, it seemed to him that there was a reasonable prospect of the Board increasing the dividend, and then the shareholders would not feel the reduction caused by the income-tax.

The Chairman having thanked Mr. Oke for his encouraging report,

The motion was unanimously carried.

Moved by the Chairman, and seconded by Mr. Charles Hunt, the retiring Directors (Mr. W. G. Bradshaw and Mr. Louis Penny) were cordially re-elected.

Moved by Mr. F. R. Smith, and seconded by Mr. Samuel Spencer, the appointment of Mr. Ernest W. Drew, F.C.A., as an Auditor, was confirmed; and Mr. Spencer Gore Brown (the retiring Auditor) was re-appointed.

Mr. Oke moved a vote of thanks to the Chairman and Directors and to the officers and staff in Bombay. Reverting to his visit to Bombay, he said he should like to add that, on the day he went to the works it was the first on which Mr. Burch was there upon his return from this country; and he (Mr. Oke) was much impressed by the pleasure it gave those who worked under their Engineer and Manager to see him back again. He (Mr. Oke) came away feeling that the Company had in Mr. Burch a valuable Engineer. He also saw Mr. Lane, who had been a valuable *locum tenens* to Mr. Burch. He considered their officers were doing their work for the Company in the best possible manner.

Mr. S. Gore Brown seconded; and the motion was heartily carried.

The Chairman—having apologized for the absence of Field-Marshal Sir Evelyn Wood and Mr. Louis Penny, who are members of the Board, and the former of whom is now recuperating at the seaside, and the latter is slightly indisposed—said it was a great pleasure to the Board to hear Mr. Oke speak as he had done regarding their officers and the conduct of their affairs in Bombay. He (the Chairman) could not use any terms exaggerating the advantage the Company had received from Mr. Burch. Ever since he first landed in Bombay, not only the make of gas per ton, but the business had continued to increase. He was sure Mr. Burch would be very pleased to read the remarks of Mr. Oke and Mr. Sibson. The figures in the accounts showed great improvement; and there was nothing like placing honour where honour was due. Mr. Lane was also a very efficient officer in the outdoor department, who was also competent to assist Mr. Burch on the works. They had several good European officers in Bombay, as well as in London. Mr. Sibson had paid a compliment to the Secretary and to his assistant Mr. Comber. All honour and all respect and proper reward were due to those who were placed in positions of responsibility in such a Company, and who conducted themselves so well as their officers had always done.

The motion was heartily agreed to.

The Secretary said he felt sure his colleagues in Bombay would wish him to express, on their behalf as well as on behalf of the staff and employees generally, their hearty thanks for the laudatory remarks that had been made in regard to their services. Mr. Burch had assured him that these resolutions were not considered as any mere matter of form. They were posted up both at the Bombay offices and in the works; and there was always great interest evinced by the staff in the appreciation of their services. He might say that the resolution would be received with no feeling of ordinary gratification on this occasion, more especially having regard to the fact that the energies of the staff were taxed to the utmost to see that everything was in order, and everything done, on the occasion of the Royal visit. On behalf of the London staff and himself, he also thanked the shareholders.

PUBLIC LIGHTING OF HEREFORD.

The report of the Gas Committee which was adopted at the last meeting of the Hereford Town Council contained a recommendation that certain improvements in street lighting in the centre of the city should be made during the coming summer, out of revenue. The scheme included certain extensions of the high-pressure main. The cost of carrying out the proposal was estimated by the Gas Engineer (Mr. W. W. Townsend) at £258, to which had to be added £50 for increasing the capacity of the compressor plant. The necessary high-pressure mains and the increased capacity of the compressor plant will be utilized for ordinary gas supply as well as for street lighting.

In proposing the adoption of the report, Mr. Witts pointed out that for some time past the Committee had been improving the lighting in the centre of the city; and so successful had they been, that they had determined upon the extensions mentioned in the report. In doing this, no extra charge would be put upon the Lighting Committee. The Gas Committee felt that, having two or three years ago reduced the price of gas to the ordinary consumers, and a little previously to penny-in-the-slot consumers, they ought to give the ratepayers, as such, some advantage; and they were now going to give them, and the citizens generally, a better light. The high-pressure system had undoubtedly revolutionized public lighting; and at the present time the Committee were giving the city an extremely good light. The extra cost to the Gas Committee would be confined to the hours between lighting-up time and midnight, because after that the high pressure would be turned off, and the small burners turned on. The double burners to be installed would be lighted and extinguished automatically; and one burner out of the two would be extinguished at midnight. It would be a relatively small cost; and he believed that by making the high pressure available in certain places they would get a good deal of extra consumption. Their experience had shown them that every improvement they had made in the past had been followed by extra consumption, and every concession given had led to increased revenue.

COAL STRIKE AND THE BIRMINGHAM GAS SUPPLY.

Restoration of the Full Supply.

By a decision come to at a meeting of the delegates of the Miners' Federation at Westminster on the 6th inst., the general strike of miners, which commenced on the 1st of March, and has been attended with such disastrous results to some of the principal industries of the country and those engaged in them, was officially terminated. As recorded in our columns, the prevalence of the strike necessitated the curtailment of the gas supply in a number of places; one of the most important being Birmingham. The Gas Committee of the Corporation were, however, among the first to take advantage of the improved position of affairs in the coalfields; and they have been able to obtain supplies of coal, principally from North Staffordshire, which enabled them to meet the demands made upon them. They were further assisted by the diminished output consequent upon the closing of the majority of business places for the Easter holidays. With their present anxieties relieved to a great extent, and with the immediate outlook hopeful, the Committee have been able to relieve householders of the inconveniences attending the restricted supply of gas lately in force. A special meeting of the Committee was held on Tuesday evening, when the whole position was reviewed; and at the close, an official intimation was given that as from 7 p.m. next day the full supply of gas would be restored. Previously, it may be remembered, the gas was cut off from 4 a.m. till 11.30 a.m., and from 1.30 p.m. till 7 p.m. The removal of the restriction was greatly appreciated by tradesmen, who had been compelled to resort to other means of lighting, and by business firms who had been hampered by the short supply; while to housekeepers it came as a welcome relief to the anxieties entailed by the difficulties of culinary operations since the full service of gas was not available. The Committee's decision, it is understood, will not apply immediately to public lighting, which will be resumed gradually as the position of the Gas Department improves.

Interviewed on the subject of the restoration of the full supply of gas, Sir Hallewell Rogers, the Chairman of the Committee, paid a tribute to the Secretary and Manager of the Gas Department (Mr. R. S. Hilton); remarking that the ability of the Committee to remove the restrictions was entirely due to his efforts. From his knowledge of the coalfields generally, he was able to procure quantities of coal sufficient to tide the Committee over the next week or so, by which time they expected to get the full supplies under their contracts. They had had to buy a great deal of coal outside, and, of course, the prices paid had been high; but it was the intention of the Gas Department to enable the factories to have a full gas supply at the earliest possible date, irrespective of what the cost might be. The large bulk of consumers had been very considerate to the department, and there had been but few complaints as to the management. Birmingham was not situated in the midst of coalfields. The average distance over which the department had to bring coal was 75 miles. They were entirely dependent upon the railways, and had never been able to get their stocks right since the railway strike of August last. The large London Gas Companies obtained their coal from Durham entirely by water, and therefore had been able to maintain their stocks. It must be remembered, added Sir Hallewell, that Birmingham had the largest gas-works outside London, and the third largest in the United Kingdom; and the demands made upon the department were exceedingly great from a manufacturing point of view.

DEMAND FOR COKE DURING THE COAL STRIKE.

As already recorded in the "JOURNAL," the scarcity of coal consequent upon the prolonged strike of coal miners caused an unprecedented demand for coke; and outside the gates of gas-works in various parts of the country crowds of men, women, and children waited for hours to secure the small quantities in which the fuel was being doled out.

One of the towns in which the demand for coke was very great was Glasgow, where the sales up to last Wednesday averaged the astounding number of 25,000 per day. We have received from Mr. Alex. Wilson, the Engineer and General Manager of the Corporation Gas Department, three photographs taken at the different gas-works; and they show clearly the character of the great crowds which had to be dealt with. At first, it was rather difficult to regulate the business—the circumstances being so unusual; but with the aid of a few policemen the despatch of coke has since proceeded with great regularity. It may be hoped, now that the strike has ended, and the warmer weather is approaching, that the "run" will gradually subside, and the vicinity of the works assume its accustomed appearance.

Manchester was another place in which there was an enormous demand for coke in small quantities. It was put up in pennyworths; but the sale of these was discontinued last Saturday. The Gas Committee intend to supply as much coke as possible to manufacturers, who have been complaining that their works have been seriously affected, and that in some cases a stoppage has been caused, by the shortage of this fuel. The Superintendent of the Gas Department (Mr. F. A. Price) says it is hoped that this week sufficient coal will be available at a reasonable figure to render the poor independent of the coke supply. A notice has been posted at the various gas-works to the effect that as from the 15th inst. coke will only be supplied to poor people in measures at 6d. and in half-measures at 3d., until further notice.

Thousands of small lots of coke have been sold at the Gainsborough Gas-Works during the past few weeks. Indeed, the applications for the fuel were so numerous lately that the Gas Engineer and Manager (Mr. John Baldwin) was compelled, in order to relieve the troubles of as many people as possible, to reduce the quantity allowed to each applicant to 28 lbs., for which the reasonable charge of 3d. was made. One day, about 300 of these lots were sold; so that some idea may be formed of the extent of the fuel famine in the town. Apart from the hundreds of grates supplied by means of the small quantities of coke, the users of gas-stoves have been enabled to husband their coal supplies owing to Mr. Baldwin's forethought. He took the precaution to add considerably to his stock of coal when the rumours of a strike of miners were first heard; so that he has passed safely through the crisis, and finds himself the possessor of a stock sufficient to last some weeks.

GAS AND ELECTRICITY SUPPLY AT BURTON-ON-TRENT.

Congratulations for the Gas Committee.

At the Meeting of the Burton-on-Trent Town Council last Wednesday, the presentation of the report of the Gas and Electricity Committee evoked congratulations on the result of their labours during the recent crisis in the coal trade.

Alderman LOWE, the Chairman of the Committee, in moving the adoption of the report, said there had been a substantial increase in the consumption of electricity for power purposes; there being a rise of 13,000 units from this source, which was equal to the power consumption for a whole year a few years ago. He had not the slightest doubt that electricity would be more and more used for power in Burton. Alluding to the coal strike, he said it was a matter for satisfaction that the gas and electricity works had been able to keep going at full strength throughout so long a struggle. They had still a substantial quantity of coal in stock, sufficient to last for the current month at least. The pumping-station at the water-works and the electricity-works had been kept going with the coke from the gas-works. He was also glad that during the strike they had been able to supply a great deal of coke in small quantities to the poor people of the town. They did not take advantage of the market, but kept to the low prices, with the result that on many days there were upwards of 400 little customers for half-hundredweights. Their Consulting Engineer (Mr. J. Ferguson Bell) told them that had they been short of coal they would have had to pay 30s. and £2 a ton for it; so that they had done very well indeed. The Committee recommended the extension of the sulphate of ammonia plant, at a cost of £700. With regard to the Barton works, now that this place was supplied from Burton, it was proposed to dismantle them, and sell the plant and property, which he thought would fetch even more than was anticipated. In spite of the coal strike, they had been able to get a considerable amount of fine slack for the Electricity Department at a price which would not be an alarming advance on that of last year. The Committee desired that, owing to the abnormal state of the coal market, they should have power to act in the matter of coal purchases.

Mr. TARVER seconded the motion.

Alderman ROWLAND said it would be invidious if some member of the Council who was not on the Committee did not congratulate them on the satisfactory statement just made. The advantage which a town possessed through owning such undertakings as the gas and electricity works was sometimes debated; and suggestions made that they would be as well off with a company. But he had recently been in a town where coke was advertised at 23s. 6d. a ton, compared with 13s. 4d. at Burton. Thus there had been considerable advantage to the ratepayers—householders and manufacturers alike—of the town; and the Committee and management were to be heartily congratulated on keeping going not only the gas and electricity works but also the trams.

Mr. HUTCHINSON also offered his congratulations to the Committee, who, he said, had come out with great credit.

Alderman LOWE, on behalf of the Committee, thanked the Council for their congratulations, and announced that the Committee had granted the ordinary labourers and purifying men an increase in wages of ½d. per hour. They had not had an increase for a very long time; and the decision was a unanimous one.

The report was adopted.

Llandrindod Wells Gas Company.—The fifth ordinary general meeting of this Company was held at the offices, Victoria Street, S.W., last week—Mr. Charles Hunt presiding. After providing for payment of the debenture interest, and including the amount brought forward, the credit balance was £480. This would have justified a small dividend; but, in the interests of the undertaking, the Directors deemed it advisable to carry the amount forward. Additional debenture stock to the extent of £1200 was issued during the year. The Chairman, in moving the adoption of the report, said it was one showing substantial progress. It had been deemed necessary to increase the loan capital to £2700, the interest on which would fall due this year; but the further charge on the profit and loss account would not be much more than £100. Thanks to the foresight of the Board and their Manager (Mr. C. E. Gregson), they had been enabled to supply gas during the coal miners' strike without any extra cost. The report was adopted.

Poisoning by Coins from Prepayment Meters.—An inquest was held at East Ham last Tuesday on the body of Abraham Robinson, aged 27, a collector in the employ of the Gaslight and Coke Company; his duty being to collect coppers from prepayment gas-meters. For the last month he had been in ill-health, and was under the care of Dr. J. E. Feeley, who expressed the opinion that deceased was suffering from metallic poisoning in some form. Robinson told the doctor that he called at a hundred houses a day collecting coins which were very often green, and when he had done collecting his hands were frequently discoloured. The doctor told the Coroner that the deceased had a long moustache, which he curled with his fingers, and by doing this he had absorbed the verdigris. On the 15th of March he ordered him to go to bed; and he died on the 2nd inst. A post-mortem examination showed that death was due to chronic metallic poisoning. The Jury returned a verdict in accordance with the medical evidence, and suggested that some method might be devised to prevent the handling of so many coins by the collectors. Speaking on behalf of the Company, Mr. Green said he did not think the suggestion was a practical one at present. The difficulty was that the bank would not take coppers unless they were put up in 5s. packets; and this necessitated counting.

MUNICIPAL EMPLOYEES' WAGES IN LANCASHIRE.

The Campaign for Advances.

Addressing a meeting of the Leigh branch of the Municipal Employees' Union on Friday night, Councillor J. T. Jones, of Manchester, the Provincial Secretary, made certain references to the recent strikes which had taken place in a number of Lancashire towns in connection with the men's demand for increased wages and improved conditions in working. He claimed that he had been instrumental in raising the wages of about 30,000 corporation workers in the short space of three months; these advances ranging from 1s. to 11s. a week. Mr. Jones had little to say about the recent municipal strike fiasco in Salford; contenting himself in this respect by giving particulars of the advances granted by the Town Council to the men prior to the last disturbance, which arose out of an alleged intimidation of certain members of the Municipal Employees' Union. It was mentioned that the Union had succeeded in establishing a minimum wage in quite a number of Lancashire towns. In Manchester, 20,000 Corporation workers were now getting 1s. per week extra because of the efforts of the Union. "I have been told," added Mr. Jones, "by a Member of Parliament, who has been one of the famous leaders of the Labour Party, that the Municipal Employees' Union have got more concessions in Lancashire in three months than any other labourers' trade union has ever got in the whole of its history."

Increased Wages for Gas Workers.

An all-round increase in wages to stokers, engine, boiler, and sulphate men, as well as unskilled labourers employed in both the gas and water departments of the Widnes Corporation, is estimated to mean an increase in the wages bill of £400 per annum.

The Mossley Town Council have approved a new scale for gas workers in their employ. Firemen and stokers are to be paid in future time-and-a-half for Sunday work, and labourers are to have a minimum wage of 25s. a week of 53½ hours. Hitherto firemen and stokers in the gas-works have been paid time-and-a-quarter for Sunday labour.

The report of a Special Committee appointed by the Southport Town Council to consider the wages and conditions of employment of workmen in the employ of the Corporation will be brought before the Town Council to-day. The Committee recommend the payment of a minimum wage of 26s. per week; and the employees are to have six days' holiday per annum, with full pay—being one more day than now granted. In the gas-works, the following rate of pay (exclusive of overtime) is recommended: Coke elevator men, 26s. per week; stoking machinery men, 5s. 6d. per shift; prepayment meter inspectors, 41 hours per week and 33s. pay; chief prepayment meter inspector, 35s. per week; ordinary meter inspectors, 30s. per week; service and yard labourers, 26s. per week.

A Sub-Committee of the Bury Corporation Gas Committee have under consideration an application for an increase in wages made by the stokers, firemen, coal and coke elevator men, engine and boiler men, and sulphate men. An advance of 3d. per day on present rates is asked for; and the request is made that all men in the Gas Department be allowed four days' holiday annually, with pay.

At Friday's meeting of the Bolton Corporation Gas Committee, a letter was read from the Gas-Workers' Association making application for increased wages to various classes of workers. The Committee were also asked to receive a deputation from the Association with reference to the system of working which now obtains at the Gas Street works. The letter was "received," and consideration of the matter deferred pending the receipt of a report on the subject from the Gas Engineer. At a private meeting of the Town Council held on the Tuesday, it was resolved that all workmen in the employ of the Corporation be granted six days' holiday each year with pay, if of six months' continuous service with the Corporation.

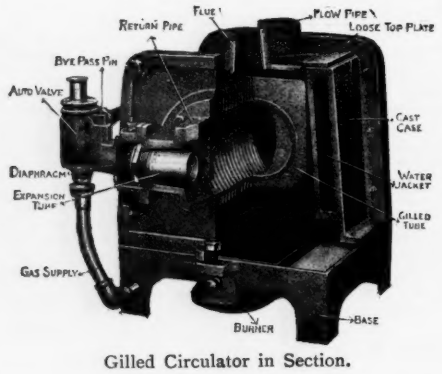
Gas workers in the employ of the Macclesfield Corporation have, through their Trade Union, made application for increased wages and an alteration of the existing arrangements as to holidays. The demands include a minimum wage of 25s. for lamplighters and general labourers, 1d. extra per hour for men having other occupations, and a week's holiday each year, with pay.

ECONOMY OF TAR-SPRAYING FOR ROADS.

There has lately been published the ninth annual report of a Committee, of which Mr. A. C. Morton, M.P., is Chairman, appointed at a conference of representatives of Metropolitan Borough Councils in 1903 to consider the general question of materials and means of paving the streets of London. It appears from the report that the principal kind of paving laid down last year in the main roads was creosoted soft wood, generally laid close-jointed and "grouted" with pitch. Some boroughs favour a foundation of portland cement concrete 9 inches thick; while others consider a 6-inch foundation sufficient, even in main thoroughfares. The most striking feature of the report, however, is the saving which has taken place, owing to the tar-spraying of macadam roads, in the cost of scavenging, watering, and maintenance. This will be strikingly apparent from the following figures in the return furnished by the Borough Surveyor of Wandsworth. They show that the cost of the scavenging, &c., services in the year 1906-7, prior to the introduction of tar-spraying, was £96,035—this sum including £7434 for new wood paving. The following year, this figure declined to £83,985, inclusive of £3067 for new wood paving; in the year 1909-10, it was £72,719, of which £11,218 was for new wood paving; and in the year 1910-11 it had fallen to £62,760, including £10,955 for the above-named purpose. The amount expended on tar-spraying in the four years was £6731; the areas dealt with being 43,969 super. yards, at a cost of £156; 244,279 yards, costing £1018; 587,229 yards, costing £2386; and 783,559 yards, costing £3171.

The returns from other boroughs also show a saving; and it is

Nothing so Compact



Gilled Circulator in Section.

as our Gilled Circulator is to be found among specialities marketed for a similar purpose.

Another feature calling for special comment in connection with this proved and tested apparatus is its

Absolute Accessibility

without disconnecting Gas and Water Pipes.

To all interested in gas-heated circulators, a call at our London Show-Rooms, 59, Queen Victoria Street, will be most profitable.

The Davis Gas Stove Co., Ltd., Luton.

agreed on all hands that there is great improvement in roads when tar-sprayed. A small area of tar macadam was laid in Hammersmith; the material used being Trinidad bitumen and granite mixed, put 3 inches thick on a foundation of old macadam road. In the opinion of the Borough Surveyor, there has been a material decrease in the cost of scavenging and watering since the introduction of tar-spraying. A large area of tarred slag macadam was laid in residential streets in the borough of Holborn, most of it with two coats 4½ inches thick, and consolidated with the steam-roller on a hard core foundation; and it is said to wear fairly well. The principal streets in Kensington were paved with creosoted deal blocks, grouted with tar, pitch, and cement, on a 6-inch portland cement concrete foundation. Large areas of tar macadam were laid in residential thoroughfares in Marylebone. In Woolwich, some 82,500 super. yards of roadway were tar-sprayed, with the result that the cost of watering was considerably decreased.

THE PROBLEM OF SMOKE PREVENTION.

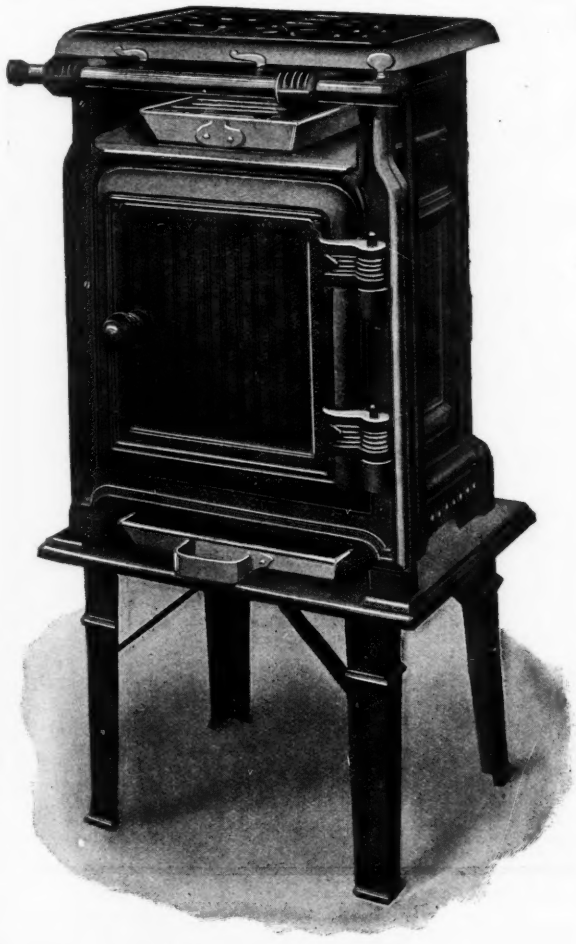
Criticism of Sir William Ramsay's Proposal.

The proposal recently made by Sir William Ramsay to carbonize coal at the pit bottom and convey the resulting gas to the surface for use in the generation of electricity for distribution, with the view of getting rid of the smoke nuisance, has been criticized in various quarters. The following are extracts from two letters which have just appeared.

Writing to "The Times" last Wednesday, Mr. Gilbert R. Redgrave said: "A rather fantastic proposal has been brought forward that, in order to avoid smoke altogether, the coal in the pits should be converted into gas, and in this form should be used at the pit's mouth to generate electricity, which might then be distributed for all domestic and industrial heating purposes. This scheme does not make any adequate provision for the use of the coke and residuals; and it would involve such vast changes in our domestic arrangements that it may at once be dismissed as impracticable." The writer considers that a far more reasonable scheme would be one on the lines suggested by Mr. W. D. Scott-Moncrieff, who dealt at the recent Smoke Abatement Conferences with the subject of "Solid Smokeless Fuel," and quoted from a letter addressed by him to "Nature" in December, 1880, under the title of "Smokeless London." He then proposed that only 3333 cubic feet, instead of 10,000 cubic feet, of gas should be extracted from each ton of coal in the retorts, and that a treble quantity of coal should be carbonized. He estimated that by this means double the quantity of bye-products would be secured, and that a fuel would be produced making a cheerful fire, and giving 20 per cent. more heat than common coal. In this way, he said that "London would become a smokeless city." Mr. Redgrave thinks that if such a plan as this were to be introduced on a sufficiently large scale by the colliery proprietor at the pit's mouth, all future difficulties with the miners would cease, since the profits would be sufficiently ample to pay almost any demands on the part of the men, and inestimable public benefits would be reaped. He points out that the employment of coal somewhat on these lines at the pit's mouth is no mere visionary scheme. The plan is already in operation abroad on a very large scale—mainly, it is true, for the utilization of the small coal and refuse; but it has been proved to be remunerative and perfectly practicable.

A writer in the "Newcastle Daily Chronicle" considers Sir William Ramsay's idea a good one; but he fails to see how it will work. He remarks: "Sir William says that air and water could be passed down to the burning coal through a bore. Suppose he put a bore down to the coal, could he ignite the coal? and if he could, and get air down, how could he supply his fire with oxygen when he got a distance away from his bore? He must put down a number of bores; and a hole from 50 to 300 fathoms is not put down easily, and costs a nice little sum. Besides, the proposal has come at a bad time; for another scientific gentleman—Dr. Harger—who read a paper on the prevention of coal-dust explosions before the Liverpool Section of the Society of Chemical Industry, tells us that if we reduce the amount of oxygen in the atmosphere from 21 to 17½ per cent., and add from ½ to 1 per cent. of carbon dioxide, we shall be absolutely safe from fire-damp, and coal-dust explosions, also from wood and coal and gob fires, as no fire could live in this mixture. So that Sir William is going to have some little trouble with his underground fire. . . . If Sir William wants to have smokeless towns and cities, let him set about it in a common-sense way. Build large gas-works near the pits, take all the gas out of the coal, and send the gas in large conduits to the towns and cities for light and heating. Lay down a large electric generating plant, and drive it with the gas coke got out of the retorts, and generate electricity (say) at 30,000 volts, and transmit it, either overhead or underground, to places where power and light are needed."

The following remarks appeared in the "Chemical Trade Journal" last Saturday: "It is an old adage which says that 'there is nothing new under the sun.' We read in our esteemed contemporary, the 'JOURNAL OF GAS LIGHTING,' that they have unearthed a patent taken out in 1909 by a Mr. Betts, of New York, for utilizing unmined coal in exactly the same way as Sir William Ramsay has suggested in his recent sensational speech before the Smoke Abatement Society. We are always unwilling to criticize any scheme that appears to be novel or even somewhat idealistic, because progress is so rapid nowadays that what appears impossible this year may be actually performed in the next; but we are afraid, after making all allowances, that even if Sir William Ramsay's and Mr. Betts' idea of igniting the coal *in situ*, and burning it to carbon monoxide, proved successful, it would only have a very limited application. It must not be forgotten that other things besides gas are produced from coal; and that coke, ammonia, and coal-tar products will always be required. But it does not seem that Sir William Ramsay has given much attention to this side of the problem."



When the limitations of space prevent the use of the ordinary type of Gas Cooker,

MAIN'S

"KENT"

or

"SUSSEX"

Cooker will be found to be just what's wanted. With or without adjustable stand.

Efficient and Economical in results.

Convenient and Satisfactory in use.

R. & A. MAIN, LTD.

WORKS:

Gothic Works, EDMONTON, N.; Gothic Iron-Works, FALKIRK; and Gothic Works, BIRMINGHAM.

SHOW-ROOMS AND BRANCHES:

25, Princes Street, Oxford Circus, W.; 136, Renfield Street, GLASGOW; 56, Broad Street, BIRMINGHAM; 83, Old Market Street, BRISTOL; 13, Whitworth Street West, MANCHESTER; 333, Queen St., MELBOURNE; 12, Cunningham Lane, Pitt Street, SYDNEY; and 8, Exchange Place, Donegall Street, BELFAST.

EXAMINATION IN "GAS MANUFACTURE" AND "GAS DISTRIBUTION" IN GLASGOW.

Question Papers at the Final Examinations.

Classes in the above-named subjects are conducted in the Department of Technical Chemistry at the Royal Technical College, Glasgow, by Mr. Henry O'Connor, Assoc.M.Inst.C.E., F.R.S.Edin.; and the final examinations in the second course in each subject took place on the 1st and 5th inst. The following were the questions set—ten in all; but the candidate was directed to answer eight only.

GAS MANUFACTURE.

1. Give details of how to stack coals to prevent spontaneous combustion, and the precautions to be taken in designing coal-stores.
2. Give an approximate analysis of a sample of fire-clay, and mention which ingredients are useful and which harmful to refractoriness.
3. State some of the points to be observed in building retort-settings, and where you would place the main flue.
4. Give the percentages of the various losses of heat from a retort-setting.
5. Show how many heat units are obtainable in the various parts of a producer from 1 lb. of coke.
6. How would you test the flue gases of a setting?
7. Describe a retort-house governor, and state its uses.
8. Describe the Carpenter system of reversible condensers.
9. How much air should be used to revivify oxide of iron in proportion to H_2S in gas; and where should the air be introduced?
10. Describe what precautions you would take to ensure a complete recovery of the ammonia.

GAS DISTRIBUTION.

1. What effect has the proportion of air taken in at the base of a bunsen burner upon the temperature of the flame, the size of same, and the light given by an incandescent mantle used over such flame? Which portion of the flame is hottest?
2. State a method of obtaining the correct size of pipes to be used in a house for any number of brackets, pendants, &c.
3. Describe, with sketch, one form of pressure governor. State whether it governs inlet or outlet pressure, and what it is used for.
4. State how many candles per cubic foot of gas can be obtained with flat-flame, argand, regenerative, incandescent, "C," Kern, inverted, and high-pressure burners, and show the difference in heat given off by each when consuming the same quantity of gas.
5. What volume of air and oxygen is required for the complete combustion of H, CH_4, CO, ethylene, and propylene?
6. What proportion of the heat of the gas is obtainable, as radiant heat, as convected heat, and as conducted heat, from a modern gas-fire? State why the modern form of "radiant" gives better results than the old ball "fuel."
7. Sketch the connections for a gas-heated hot-water system.
8. How many B.Th.U. can be obtained from one cubic foot of H, CO, CH_4, ethylene, and propylene?
9. What effects has the increasing of the pressure of the gas on the flame of a bunsen burner? Describe the action and results.
10. Describe the meaning of the following expressions: A volt, an ampere, an ohm, a Board of Trade unit, a watt-hour, and how many B.Th.U. can be obtained for one watt-hour.

COAL-GAS APPLIANCES FOR COMMERCIAL PURPOSES.

Their Use and Construction.

The following notes are extracted from a lecture on "Gas-Heated Furnaces," delivered by Mr. G. F. HURST [John Wright and Co.] to students of the Liverpool Technical Institute.

The use of coal-gas appliances for commercial purposes has become a matter of great importance to all gas undertakings. Furnaces consuming up to 4000 cubic feet per hour are now in daily use, and, for processes that are worked intermittently, show a large saving in fuel-cost to the users. In addition to this, the increased speed of production (which is often doubled), and the consequent saving in labour, together with a further saving of labour owing to the absence of stoking, clinkering, and the removal of ashes, often make the gas-furnace a highly profitable investment. The adoption of gas appliances has also enabled many consumers to produce a class of work far superior to, and much more uniform in quality than, that ever obtained by the use of solid fuels.

One of the greatest difficulties one will have to contend with in advocating the adoption of gas-heated appliances is obtaining from the possible user absolutely correct information regarding the process for which the apparatus is required, and the conditions under which the work has to be carried out. One cannot be an expert in every trade, and familiar with all processes of manufacture; neither is it possible for one to supply satisfactory apparatus without being in possession of all the conditions that the apparatus he is called upon to supply has to fulfil. When dealing with any inquiry, one cannot ask too many questions. What may seem trifling matters at an interview, or other points that one may be inclined to take for granted, may eventually turn out to be matters of the greatest importance, and are often the very matters which decide whether a success or a failure is made of the work undertaken. Until this class of work is taken in hand, one will hardly realize to what a great extent rule-of-thumb methods are employed by manufacturers of the present time.

In order to thoroughly satisfy consumers, it is necessary to select the type of furnace with the greatest care; and at the start one is con-

THE CALEFACTOR No. 7.

Test the CALEFACTOR

Everybody else is Testing it.

Since particulars of it were published, only three weeks ago, we have had many hundreds ordered.

Not the most popular of our former inventions ever had such a "run."

JOHN WRIGHT & CO.,
Essex Works,
BIRMINGHAM.

Test the Calefactor.

30A.

fronted with three possible methods of applying gas to the work in hand, each of which, under certain conditions, and provided the construction of the furnace is carried out on the correct lines to suit the class of work for which it is intended, possesses advantages over the other systems of application. Where temperatures not exceeding 1100° C. are required, and the size of the furnace is within certain limits which vary with its shape and the nature of the work for which it is designed, natural-draught furnaces can be installed. The easy method of adjustment, the correct regulation of temperature afforded, when heating-up, cooling-down, or running at a given temperature, which can easily be maintained within a limit of 5° C., the fact that there is no outlay for a power-blower or gas-compressor, or the power required for running them, together with the small cost of fittings, are important factors highly in favour of natural-draught furnaces.

High-pressure gas in itself is an admirable method of applying gas for furnace work where any temperatures not exceeding 1400° C. are required. The use of properly proportioned burners, adjusted to give the necessary maximum temperature, and fixed in correct positions to ensure an even temperature throughout the furnace, places a convenient range of temperatures at the disposal of the user. The range of temperatures in any given furnace is not so extensive as that of natural-draught furnaces; but the maximum temperature obtainable with gas at a pressure of 12 lbs. to the square inch is higher than that of the natural-draught furnaces, and at the same time more efficient in working. By the system of applying gas at ordinary pressure with an air-blast, the highest temperatures obtainable with coal gas and air are secured; the limit for all practical purposes being approximately 1700° C. The largest types of muffle and oven furnaces are invariably fitted with air-blast or high-pressure gas burners; and there is a limit to the size of furnace that can be fitted satisfactorily with natural-draught burners. In addition to this, on account of the questions of prime cost, efficiency, and facility in working, large natural-draught furnaces are not to be recommended. Generally speaking, the air-blast burners now on the market are the most unsatisfactory of the three types of furnace-burners, and those in which of recent years the least improvement has been made; their main fault being that no arrangement is provided for the proper mixing of air and gas before reaching the point of ignition. Some makers, even to-day, are using the old type of blow-pipe burner, where gas and air mix practically at the point of ignition.

In dealing with the metallurgical work for which a large number of gas-heated furnaces are used, the question of maintaining a reducing atmosphere, combined with efficiency in working, is a most important one, and is one of the chief points in furnace construction. Theoretically, a reducing atmosphere is produced by bringing into combustion such a quantity of air and gas that the gas is in excess of the quantity which it is possible for the oxygen to consume. An oxidizing atmosphere is produced by supplying a quantity of oxygen in excess of that required to properly consume a given quantity of gas. There are in use to-day for metallurgical work a large number of draught muffle and oven furnaces fitted with burners that, though consuming gas in the proportion of from 2½ to 3½ cubic feet of air to 1 cubic foot of gas, are constructed in such a manner that a highly oxidizing atmosphere is obtained in the furnaces. This is due partly to the large air-space left round the burners for auxiliary air supply, which until a few years ago was thought absolutely necessary in the construction of all natural-draught furnaces. In order to remedy this defect, we have designed a burner which can be entirely enclosed in the base of the furnace, doing away with the auxiliary air supply and taking the air necessary to support combustion through the burner-tubes—gas and air being thoroughly mixed before reaching the point of ignition. The efficiency in furnace heating depends largely on the design and placement of the burners; but the space in which combustion can be completed also plays a very important part. The smaller the space in which combustion can be completed, the greater the efficiency and the higher the temperature attainable.

STAFFORD WATER-WORKS EXTENSIONS.

The water-works of the Stafford Corporation at Milford have lately been extended; and the ceremony of reopening them was performed last Wednesday by the Earl of Lichfield, from whose estate the water is obtained. Among the company present were the Countess of Lichfield, the Mayor and Mayoress of Stafford (Alderman and Mrs. Taylor), the Chairman of the Water Committee (Mr. T. A. Dunn), and the Borough Engineer and Water-Works Superintendent (Mr. W. Plant, Assoc.M.Inst.C.E.), who designed the extensions, and under whose direction they have been carried out.

The proceedings were conducted by Mr. Dunn, who first called upon the Earl of Lichfield to turn the water into the rising main. This his Lordship did by opening the valve, at the same time expressing the hope that the increased supply of water would prove of the utmost benefit to the inhabitants of Stafford and the district. Subsequently Alderman Smallman (the senior member of the Water Committee) presented the Mayor with a gold key, and asked his Worship to open the door of the works. The Mayor said he had watched the development of the works for many years, and considered they had now reached a high stage of efficiency. The Committee had done all that was possible to ensure a plentiful supply of water for the town and district. In the name of the Corporation, and on behalf of the ratepayers, he was pleased to open the works. The door was then opened by the Mayor with the gold key, and the company entered the new engine-room. The starting of the machinery was next performed; the task being undertaken by the Countess of Lichfield, who said that she and the Earl appreciated the efforts which had been put forward, and hoped the result would be a satisfactory and increased supply of pure water for Stafford.

The company then passed into the old engine-room, and Mr. Dunn

Gas Plant and all constructional Steel and Iron Work.

Specialists in Slot Meters, Ordinary Meters, Wet & Dry.

WILLEY & CO., LTD., ENGINEERS,

LONDON & EXETER.

The Pioneers of Slot Installations.

Gas Fires.

Gas Fittings.

Gas Cookers.

PICKERING'S VALVE. LIVESEY WASHERS.

Telegrams: "WILLEY, EXETER."

NOTE ADDRESSES.

Head Offices: EXETER.

London Offices: 18, ADAM STREET, ADELPHI, W.C.

SHOW-ROOMS: LONDON, 18, Adam Street, Adelphi, W.C.

proposed a vote of thanks to the Earl and Countess of Lichfield. He said the Water Committee regarded that as a red-letter day, and one which marked an epoch in the Stafford water-works undertaking. Mr. Dunn then proceeded to refer to the generous manner in which the Earl of Lichfield had met the Corporation in the negotiations, which resulted in Stafford receiving the inestimable gift of an unlimited supply of pure water. The vote having been most heartily accorded, the Mayor presented to the Earl and Countess a commemorative album. In acknowledging the vote and the gift, his Lordship referred to the inauguration of the works twenty-two years ago, and said that just as his father then consulted him on the water question, so now he had consulted his eldest son; and he was glad to say that, both then and now, his family had been, and were, unanimous in desiring to give every facility in their power to enable Stafford to acquire a pure and abundant supply of water. He thanked the company for their kindness to the Countess and himself, and said they both hoped the additional water available would be productive of ever-increasing prosperity and happiness to the inhabitants of the old county town.

The company then assembled at an hotel in the town, where tea was served, and a few toasts were honoured. Mr. R. W. Essex, the Member of Parliament for the borough, proposed "Success to the Stafford Water-Works Undertaking." Mr. P. G. S. Moss (the Vice-Chairman of the Water Committee) proposed the health of Mr. Dunn, and presented him with a commemorative album. Mr. Dunn replied to the toast, and acknowledged the gift. He said the Contractors had carried out their work most successfully. Their tender, which was the lowest, amounted to £4218; and when they remembered that the highest was £7778, they might congratulate themselves upon having such fine plant. Alderman C. H. Wright proposed "The Water-Works Engineer," and referred to the excellent work of Mr. Plant, who responded. He afterwards described the water undertaking.

Description of the Works.

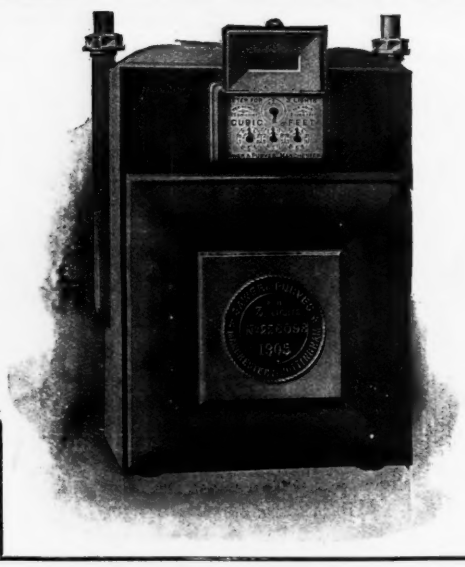
The works were first opened in 1890, after many abortive attempts at securing a supply of water on Stafford Common, at Berkswich, and at Enson Moor. The late Earl of Lichfield gave the Corporation permission to test the yield of water on his estate. As the results proved satisfactory, the Corporation decided to erect the works on the site; and the formal opening took place on March 17, 1890. They supply water to a number of places in addition to Stafford. More than 25 miles of mains have been laid; and the pressure in Stafford varies from 80 lbs. to 100 lbs. per square inch—this being sufficient at all times to overtop the highest buildings in the town. The population supplied is about 27,000; and the quantity of water raised at the pumping-station during the year ended the 31st ult. was 240 million gallons.

The pumping has hitherto been done by two horizontal condensing engines, with double-acting pumps of the plunger type. The reservoir has a total capacity of 577,000 gallons, equal to about one day's average supply. The top water-level in the reservoir is about 240 feet above the engine-room floor, and 234 feet above the level of the Market Square in Stafford. The new machinery consists of a triple-expansion vertical rotatory condensing engine, with three-throw plunger pumps. When working at normal speed (30 revolutions per minute), it is capable of raising 1400 gallons per minute from the well to the reservoir; the maximum lift being 280 feet. The engine is fitted with Corliss valves, and is operated by superheated steam at an initial pressure of 150 lbs. per square inch. The steam-cylinders are 14, 23, and 36 inches diameter respectively; and each of the pump plungers is 14 inches diameter. The length of stroke is 2 ft. 6 in. The machinery is considered to be equal to meeting the requirements of Stafford for a long time. The new boiler is of the Lancashire type, 7 feet in diameter and 24 feet long; and with it are connected a steam superheater and economizer. The old plant will be retained as a stand-by.

NEW WATER SCHEME FOR BIDEFORD.

A Special Meeting of the Bideford Town Council was held last Wednesday, to consider a scheme prepared by Mr. Baldwin Latham for augmenting the water supply of the town at an estimated cost of £19,300. The question of the water supply has been before the Council for many years, and numerous proposals for dealing with it have been put forward, but rejected. Last year, Mr. Baldwin Latham was consulted; and the result was the recommendation of what is known as the Bibery scheme, which, after a good deal of discussion, the Water Committee recommended the Council to adopt. This provides for the construction of a reservoir at Bibery, to hold not less than 13 million gallons, and of a high-level reservoir to hold 30,000 gallons; the erection of a hydraulic pumping-station, with engines and pumps in duplicate; excavating the upper service reservoir to increase its capacity by 5 million gallons; making arrangements for the division of the area of supply into high and low level districts; and providing certain new mains, cleaning and scraping those now in use, opening-out the dead-ends, and fixing hydrants. The Town Clerk (Mr. W. B. Seldon) submitted an estimate showing that £1055 would be required annually for the payment of principal and interest. In the course of the discussion, Mr. Adams said the members of the Council had been a little staggered by the amount of the estimated cost; but if they went on dilly-dallying with the matter, they would never improve the position of the town. Alderman T. Goaman agreed that it was time the question was settled. He said he had been a member of the Council for 29 years, and every year the water difficulty had come up. Mr. Martin suggested that instead of scraping the old mains they ought to have new ones. The Mayor (Mr. W. T. Goaman) said that in committee every member of the Council present had voted for the scheme. It certainly needed a little courage to vote for an expenditure of nearly £20,000; but he believed that in years to come not one of them would regret having done so. They would have 18 million gallons more storage, and enough water for all time. The scheme was unanimously approved; and it was decided to apply to the Local Government Board for the necessary borrowing powers for carrying it out.

DRY GAS METERS.



ALL SIZES STOCKED.

SAWER & PURVES,

MILES PLATTING, MANCHESTER.

RADFORD ROAD, NOTTINGHAM.

WIRES { "SAWER MANCHESTER." "SAWER NOTTINGHAM."

TELEPHONE NOS. { 3289 (City) MANCHESTER. 2025 (Central) NOTTINGHAM.

Agent for Scotland: JNO. D. GIBSON, 2, Causeyside Street, PAISLEY.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

With the return of the miners to work, gas engineers and managers are now breathing more freely than they have done during the last five weeks. From reports received from various parts of the country, the situation was becoming very acute, and quite a large number of gas undertakings were faced with the necessity of making further drastic curtailments in the gas supply. For the present, the cloud has lifted; and matters are gradually returning to their normal conditions. It will be a week or two yet before the effects of the coal strike are finally overcome so far as the supply of gas is concerned; and in this connection it falls to be recorded that Broughty Ferry was among the earliest of the Scottish burghs to return to the old order of things when the strike was over.

The series of cookery demonstrations which have been held in connection with the Edinburgh and Leith Corporations' gas undertaking has been productive of a great demand for the fitting-up of gas-cookers. On Wednesday, a three days' demonstration and gas exhibition was opened at Portobello by Mr. Carmichael. Mrs. Gray was responsible for the fine culinary results obtained; the dishes cooked being of varied character and composition.

At the meeting of the Kirkcaldy Town Council on Monday, it was reported that the total cost of the gas undertaking was £138,421 17s. 3d., made up as follows: Price paid for the gas-works £123,816 18s. 7d., arbitration expenses £12,394 1s. 11d., cost of conveyance £1163 14s., preliminary expenses £463 5s. 1d., cost of Order £583 17s. 8d.

A Committee of the Buckhaven Town Council have been considering the question of the establishment of municipal gas-works; and they have already presented a report. At the last monthly meeting of the Council, the Committee, after having further discussed their report, submitted it again, recommended the adoption of the principle of municipal gas supply, and asked for further powers of investigation. Mr. Smart proposed that the Committee should be authorized to obtain expert advice, and that the Town Clerk should be instructed to draw up a statement as to the legal position of the Council in regard to the two existing Gas Companies. Bailie Taylor moved the adoption of the Committee's report, remarking that they had come to the conclusion that a municipality could produce gas more cheaply than a private concern. The report was adopted.

Negotiations are at present in progress between the Largs Town Council and the Glasgow and South-Western Railway Company as to the lighting of Largs Station. Some time ago, the Company resolved to lay down a petrol air gas plant at the station, and the necessary plant was brought to Largs, and a building erected to hold it. The Town Council receive an income of between £50 and £60 per annum from the Railway Company; and a deputation from the Corporation was appointed to proceed to Glasgow with the view of inducing the Company to adhere to the use of the town gas. It was pointed out that a sum of about £350 per annum was paid for carriage to the gas-works alone. The Company, on the other hand, mentioned the great cost of the gas—viz., 4s. 2d. per 1000 cubic feet—and also referred to the charges made for town water, of 7d. per 1000 gallons for the first million gallons, and 6d. per 1000 gallons after. The Town Council have now agreed to reduce the price of water to a uniform rate of 6d. per 1000 gallons if the Company do not proceed with the erection of the gas plant.

On Wednesday, evidence was heard before Mr. J. Walker Smith, the Engineering Inspector of the Local Government Board, as a Commissioner under the Housing and Town Planning Act, in Dunfermline, regarding the scheme of town-planning prepared for the Rosyth area recently included within the boundaries of the burgh by the Town Council. Mr. W. R. Maxwell, the Borough Engineer of Dunfermline, gave evidence as to the capacity to supply gas and water. Mr. Alex. Waddell, the Gas Engineer, also stated that they could easily supply gas to the new area. Their rate was 2s. 3d. per 1000 cubic feet, and was one of the cheapest in Scotland. They supplied gas to the villages of Limekilns and Charlestown at the rate of 4s. per 1000 cubic feet. The Commissioner reserved his decision.

In the course of a protracted discussion at the meeting of the Glasgow Town Council on Thursday, over a proposal to establish municipal coal depôts, which was negatived by 37 votes to 10, it transpired that the Corporation bought annually a million tons of coal.

On Wednesday, in Dundee, a householder went to look for an escape of gas with a naked light. The result was that the fire brigade had to be summoned, and their timely arrival prevented serious damage.

In Glasgow, in consequence of the policy of selling coke in small quantities, an enormous amount was disposed of during the coal strike. So great was the demand, that long queues had to be formed. Mr. Wilson, the Gas Engineer and General Manager, took a warm personal interest in the distribution of the supplies. [This matter is referred to elsewhere.] Dundee also participated in the rush for cheap fuel; and at the gas-works on several days as many as 750 bags were sold at 2d. each. Mr. Yuill also made arrangements for an accelerated distribution.

The new water supply to Sanquhar was successfully inaugurated on Thursday. The scheme cost £1600; and the Engineers were Messrs. Warren and Stuart, of Glasgow.

The Local Government Board have given approval for a loan of £2068 to be raised by the Banffshire District Committee for capital works in connection with the additional water supply to the Whitehills water district.

The prospectus of the Scottish Tube Company, the registration of which was noticed in the "JOURNAL" last week (p. 126), has now been published. The capital is fixed at £750,000, and the issue to the public is to be £200,000, in 5 per cent. convertible mortgage debenture stock. The Chairman of the Company is Sir Thomas Mason.

PARKINSON

"CROWN"

COOKERS.

Only the best materials and workmanship are utilized in the manufacture of the "Crown" Cooker, and combined with its practical construction provides the perfect cooker of which thousands are in daily use.

The "Crown" Cooker is replete with all modern improvements. Every part is standardized and replacement parts can be supplied immediately on receipt of order.

PERFECTLY CONSTRUCTED.

THE PARKINSON STOVE CO., LTD.,

BIRMINGHAM AND LONDON.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *April* 13.

Sulphate of Ammonia.

On the one hand, the protracted coal strike has resulted in an appreciable curtailment in the production of sulphate of ammonia, while, on the other hand, the exports for last month show a big increase, as compared with March, 1911. Consequently, the amount of trade in the near position has not been large, but the parcels which have been offered for sale have continued to be readily absorbed at still hardening prices. The nearest values at the close are £15 per ton f.o.b. Hull, £15 1s. 3d. per ton f.o.b. Liverpool, and £15 2s. 6d. per ton f.o.b. Leith. There is not much interest being displayed for future delivery; but it is reported that £14 10s. per ton, f.o.b. good port, has now been realized for equal monthly quantities July-December, 1912.

Nitrate of Soda.

No new feature has presented itself in this article, and the market remains, without alteration in either tone or value, at 11s. per cwt. for ordinary, and 11s. 1½d. for refined quality, on spot.

LONDON, *April* 15.

Tar Products.

The markets for tar products continue firm, though there is not a great amount of business doing at the moment. Although there is no alteration in value, pitch is decidedly steady. The inquiry for near and forward delivery is particularly good. Benzols are firm, though there is little or no business doing. There is a good inquiry for heavy and solvent naphthas. Carbolic acid is at a standstill. Creosote remains firm, and there is a good inquiry for delivery this year.

The average values during the week were: Tar, 26s. 6d. to 30s. 6d. *ex* works. Pitch, London, 50s. to 50s. 6d.; east coast, 49s. 6d. to 50s.; west coast, Clyde 48s. 6d. to 49s., Manchester 48s. to 49s., Liverpool 49s. to 50s. Benzol, 90 per cent., naked, London, 11d. to 11¼d.; North, 10½d. to 10¾d.; 50-90 per cent., naked, London, 10d.; North, 9½d. Toluol, naked, London, 10d. to 10½d.; North, 9½d. to 10d. Crude naphtha, in bulk, London, 4½d. to 5d.; North, 3¾d. to 4¼d. Solvent naphtha, naked, London, 1s. to 1s. 0½d. f.o.b.; North, 10¾d. to 11d. f.o.b. Heavy naphtha, naked, London, 11d. to 1s. f.o.b.; North, 10d. to 10½d. f.o.b. Creosote, in bulk, London, 2⅝d. to 3½d.; North, 2½d. to 2⅝d. salty, 2⅝d. to 2¾d. liquid. Heavy oils, in bulk, 3¼d. to 3⅜d. Carbolic acid, casks included, 60 per cent., east and west coast, 2s. 7d. Naphthalene, £4 10s. to £8 10s.; salts, 40s. to 45s., bags included. Anthracene, "A" quality, 1¼d. to 1¾d. per unit, packages included and delivered.

Sulphate of Ammonia.

Although this article has quietened down during the last few days, the market is decidedly firm, and in some quarters the price has improved. Actual Beckton is quoted to-day at £14 5s. Outside London makes are £14; Hull, £14 16s. 3d. to £14 17s. 6d.; Liverpool, £14 17s. 6d. to £14 18s. 9d.; Leith, £15; Middlesbrough, £14 18s. 9d.

COAL TRADE REPORTS.

Northern Coal Trade.

With the resumption of work at the collieries, somewhat tardily, there is again a pressing demand for coal, and the prices are in consequence rather high. In the steam coal trade, best Northumbrians are from about 18s. to 19s. per ton f.o.b.; and second-class steams are from perhaps 16s. 6d. to 17s. 6d. The prices vary, however, with the different collieries according to the quantity of free coal each may have after meeting contracts. The production at the collieries will only slowly return to its full amount, for the pits have been disturbed in the long period of the strike. Gas coals are still scarce, though they are now being delivered more freely on contract. For best Durham gas coals, about 17s. 6d. to 18s. per ton f.o.b. is quoted; and for second qualities

GAS COMPANIES' STOCK AND SHARE LIST.

The Stock Exchange reopened on Tuesday after the Easter holiday in a very good mood, evidently determined to take a bright view of things in general. This pleasurable form was rather rudely disturbed in mid-week; but it again recovered, and matters were once more quite all right by the close. Not all the chief departments, however, participated in the sunshine. Consols, for instance, closed ⅛ lower, and Americans were depressed; but there was a widespread feeling of confidence in many markets that a good time is coming. On the opening day, business was rather quiet—not all members having returned from their exodus; but general firmness was the rule. Government issues were quite strong, and Consols gained ⅛. Rails were cheered by the cessation of the strike, and prices rose, but not to any great extent. The Foreign Market was calm. Wednesday opened brightly enough, but soon became quite overcast, and markets went to pieces. Gilt-edged were weak. Consols lost the point they had gained, and Rails were nearly all down at the close. This chilling influence prevailed on Thursday, and prices shrank generally, though in some quarters there was a slight rally towards the end. Government issues were particularly weak, and Consols receded ¼; while Rails were all on the down line. Friday produced an enlivening change; and markets were buoyant, with rising prices. Even the settlement of a fairly large account could not check business. A fair recovery in gilt-edged was seen, though Consols did not move; and Rails were quite strong and active. Saturday maintained this firm tone, and was more than usually active. Consols rose ⅛—closing at 77⅞-78⅛. Rails were fairly strong, and several speculative quarters were full of enterprise. The Money Market was firm, there being a demand in excess of the supply; and discount rates were stiffer. Business in the Gas Market was much better, quite participating in the general revival inaugurated more or less throughout the Exchange. The tendency was favourable; but not many quotations underwent any change. In Gaslight and Coke issues, the ordinary was moderately active, and transactions were much the same as the week before—ranging from 102⅜ to 103½. In the secured issues, the maximum was done at 85½ (a rise of ½), the preference at 103¼, and the debenture at from 78¼ to 79¼—a fall of 1. South Metropolitan was quiet and strong, changing hands at 117 to 118—a rise of 1. In Commercials, the 4 per cent. realized 108½ and 110, the 3½ per cent. 104, and the debenture 75⅛. Among the Suburban and Provincial group, Alliance and Dublin debenture marked 90, Brighton original 219, Brentford preference 118½, British 45⅜ and 45⅛, Lea Bridge 126¾, South Suburban 122¼, Tottenham "B" 114¾, and (on the local Exchange) Liverpool "B" 160. In the Continental companies, Imperial advanced 2, marking from 189¼ to 192½, Union made 83½, ditto preference 137 and 137½ (a rise of 2), European 20⅛ and 20⅜, and Tuscan 8⅜. Among the undertakings of the remoter world, Bombay was done at 6⅜, Monte Video at 12, Malta at 5, Primitiva at 7 11/16 to 7 13/16, ditto preference at 5 5/16 to 5 7/16, ditto debenture at 98, River Plate debenture at 95½, and San Paulo at 11⅛ and 11¾—a rise of ¼.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
1,551,868	Stk.	Apl. 12	5	Alliance & Dublin Ord.	77—80*	+½	6 5 0
374,000	Stk.	Jan. 12	4	Do. 4 p.c. Deb.	91—93	..	4 6 0
250,000	5	Apl. 12	7½	Bombay, Ltd.	5⅞—6⅜*	..	5 17 8
50,000	10	Feb. 29	15	Bourne-mouth Gas and Water Co.	28⅜—29½	..	5 1 8
					16—16½	..	4 4 10
332,000	10	,,	7	B 7 p.c. Pref. 6 p.c.	14—14½	..	4 2 9
75,000	10	,,	6				
380,000	Stk.	,,	13	Brentford Consolidated	258—263	..	4 18 10
330,000	,,	,,	10	Do. New	195—200	..	5 0 0
50,000	,,	,,	5	Do. 5 p.c. Pref.	118—120	..	4 3 4
206,250	,,	Dec. 14	4	Do. 4 p.c. Deb.	97—99	..	4 0 10
219,055	Stk.	Feb. 29	11	Brighton & Hove Orig.	215—220	..	5 0 0
244,200	,,	,,	8	Do. A Ord. Stk.	156—159	..	5 0 8
490,000	20	Mar. 28	12½	British	45—46	..	5 8 8
120,000	Stk.	Dec. 29	4	Do. 4 p.c. Deb. Stk.	93—95	..	4 4 3
109,000	,,	Feb. 15	6	Bromley, A 5 p.c.	128—133	..	4 10 3
165,700	,,	,,	4½	Do. B 3½ p.c.	98—101	..	4 9 1
82,278	,,	,,	5½	Do. C 5 p.c.	117—120	..	4 11 8
55,000	,,	Dec. 29	3½	Do. 3½ p.c. Deb.	80—82	..	4 5 4
250,000	Stk.	,,	4	Buenos Ayres 4 p.c. Deb.	95—97	..	4 2 6
100,000	10	—	—	Cape Town & Dis., Ltd.	2—3	..	—
100,000	10	—	—	Do. 4½ p.c. Pref.	4—5	..	—
100,000	Stk.	Dec. 29	4½	Do. 4½ p.c. Deb. Stk.	76—80	..	5 12 6
157,150	Stk.	Feb. 15	5	Chester 5 p.c. Ord.	110—112	..	4 9 3
1,513,280	Stk.	Feb. 29	5/9/4	Commercial 4 p.c. Stk.	108—110	..	4 19 4
560,000	,,	,,	5½	Do. 3½ p.c. do.	103—105	..	5 1 6
475,000	,,	Dec. 14	3	Do. 3 p.c. Deb. Stk.	75—77	..	3 17 11
800,000	Stk.	,,	4	Continental Union, Ltd.	82—85	..	4 14 2
200,000	,,	,,	7	Do. 7 p.c. Pref.	136—138	+2	5 1 5
492,270	Stk.	—	5½	Derby Con. Stk.	122—124	..	4 8 9
55,000	,,	—	4	Do. Deb. Stk.	104—105	..	3 16 2
840,150	10	Jan. 31	10	European, Ltd.	20—21	..	4 15 3
16,160,600	Stk.	Feb. 15	4/14/8	Gas-light and Coke	102⅜—103⅜	..	4 11 3
2,600,000	,,	,,	3½	4 p.c. Ord.	84—86	+½	4 1 5
4,062,235	,,	,,	4	3½ p.c. max.	102—104	..	3 16 11
4,531,705	,,	Dec. 14	3	4 p.c. Con. Pref.	78—80	−1	3 15 0
258,740	Stk.	Mar. 14	5	3 p.c. Con. Deb.	93—95	..	5 5 3
82,500	,,	,,	6½	Hastings & St. L. 3½ p.c. Deb.	—	..	—
70,000	10	Oct. 12	11	do. 5 p.c.	17—17½	..	6 5 9
131,000	Stk.	Mar. 14	7½	Hongkong & China, Ltd.	152—154	..	4 17 5
65,780	,,	,,	6	Ilford A and C	123—125	..	4 16 0
65,500	,,	Dec. 29	4	Do. B	92—94	..	4 5 1
4,940,000	Stk.	Nov. 10	9	Do. 4 p.c. Deb.	190—193	+2	4 13 3
1,235,000	Stk.	Feb. 15	3½	Imperial Continental	88—90	..	3 17 9
				Do. 3½ p.c. Deb. Red.			
200,242	Stk.	Mar. 14	6	Lea Bridge Ord. 5 p.c.	125—129	..	4 13 0
561,000	Stk.	Feb. 29	10	Liverpool United A.	220—222	..	4 10 1
718,100	,,	,,	7	Do. B.	159½—161½	..	4 6 8
306,083	,,	Dec. 29	4	Do. Deb. Stk.	100—102	..	3 18 5
75,000	5	Dec. 14	6	Malta & Mediterranean	4⅜—5	..	6 0 0
560,000	100	Apl. 1	5	Met. of 5 p.c. Deb.	100—102	..	4 18 0
250,000	100	,,	4½	Melbourne 4½ p.c. Deb.	100—102	..	4 8 3
541,920	20	Nov. 10	3½	Monte Video, Ltd.	12—12½	..	5 12 0
1,775,892	Stk.	Feb. 15	4½	Newc'tle&G'tesh'd Con.	99—101	..	4 6 8
529,705	Stk.	Dec. 29	3½	Do. 3½ p.c. Deb.	86—88	..	3 19 7
55,940	10	Feb. 29	7/7/0	North Middlesex 7 p.c.	14—15	..	4 18 0
300,000	Stk.	Dec. 14	8	Oriental, Ltd.	137—139	..	5 15 1
60,000	5	Mar. 14	8	Ottoman, Ltd.	7—7½	..	5 6 8
31,800	53	Feb. 29	13	Portsea Island A	137—140	..	4 18 4
60,000	50	,,	13	Do. B	130—133	..	4 17 9
100,000	50	,,	12	Do. C	127—130	..	4 12 4
398,490	5	Oct. 12	8	Primitiva Ord.	7⅜—7¾	..	5 2 5
796,980	5	Dec. 29	5	Do. 5 p.c. Pref.	5¼—5½	..	4 10 11
488,900	100	Dec. 1	4	Do. 4 p.c. Deb.	97—99	..	4 0 10
312,650	Stk.	Dec. 29	4	River Plate 4 p.c. Deb.	95—97	..	4 2 6
250,000	5	Apl. 12	12	San Paulo, Ltd.	11¼—11⅜*	+¼	5 2 2
115,000	10	,,	6	Do. 6 p.c. Pref.	11¼—11½*	..	5 2 2
125,000	50	Jan. 2	5	Do. 5 p.c. Deb.	50—51	..	4 18 0
135,000	Stk.	Mar. 14	10	Sheffield A	235—237	..	4 4 5
209,984	,,	,,	10	Do. B	234—236	..	4 4 9
523,500	,,	,,	10	Do. C	234—235	..	4 5 1
90,000	10	Sept. 28	6	South African	8—9	..	6 13 4
6,429,895	Stk.	Feb. 15	5/9/4	South Met., 4 p.c. Ord.	116—118	+½	4 12 8
1,895,445	,,	Jan. 12	3	Do. 3 p.c. Deb.	78—80	..	3 15 0
209,820	Stk.	Feb. 29	8½	South Shields Con. Stk.	156—158	..	5 7 7
605,000	Stk.	Feb. 15	5/16/8	S'th Suburb'n Ord. 5 p.c.	121—123	..	4 14 9
60,000	,,	,,	5	Do. 5 p.c. Pref.	117—120	..	4 3 4
117,058	,,	Jan. 12	5	Do. 5 p.c. Deb. Stk.	119—121	..	4 2 8
502,310	Stk.	Nov. 10	5	Southampton Ord.	107—109	..	4 11 9
120,000	Stk.	Feb. 15	7½	Tottenham A 5 p.c. and B 3½ p.c.	144—147	..	4 17 0
483,940	,,	,,	5⅝		114—116	..	4 17 0
149,470	,,	Dec. 29	4	Edmonton 4 p.c. Deb.	95—97	..	4 2 6
182,380	10	,,	5	Tuscan, Ltd.	8⅜—8⅞	..	5 12 8
149,900	10	Jan. 2	5	Do. 5 p.c. Deb. Red.	99—101	..	4 19 0
236,476	Stk.	Feb. 29	5	Tynemouth, 5 p.c. max.	112—114	..	4 7 9
255,636	Stk.	,,	6⅞	Wands-worth B 3½ p.c. 3 p.c. Deb. Stk.	141—144	..	4 15 6
85,766	,,	Dec. 29	3		71½—73½	..	4 1 8

Prices marked * are "Ex. div."

about 17s. There is a strong demand, both on home and foreign account, as the depleted stocks have now to be replenished, and the demand for gas is fuller. The Newcastle and Gateshead Gas Company have announced that, "delivery of coal from contractors having been resumed" to them, "the normal supply of gas to consumers is available." In other local towns, the gas supply is now full; and it is probable that gas undertakings will begin to accumulate coal stocks again. Coke is in good demand. Gas coke is firm, with the output well taken up at prices that are recently quoted.

Scotch Coal Trade.

The coal trade throughout Scotland is now returning to its normal level. There is a keen demand for all classes of fuel; and on Friday the prices quoted in Glasgow, f.o.b., were approximately: House coal, 20s. per ton; splint, 17s. 6d.; ell, 16s.; and trebles, doubles, and singles 16s., 15s., and 14s. respectively.

Rational Use of the Gas-Cooker.—Mr. R. G. Marks, of Blair Grove, Southport, has prepared for distribution a folding card, explaining the several advantages of the use in gas-ovens of his patent heat distributors and meat roasters. A sample of the card can be obtained from him; and large quantities for circulation among gas consumers can be purchased at practically cost price. Every gas consumer with a gas-cooker installed should have knowledge of how to realize the best possible results out of it—results comprising economy in consumption of gas, in weight of meat, and in cleanliness of oven.

Projected Cookery Demonstrations at Cardiff.—The success which attended the Business Exhibition held at the Drill Hall, Cardiff, in February of last year, has led to a more ambitious programme to be entered upon at the Skating Rink, Westgate Street, next month. The exhibition will be open from the 4th to the 23rd of May; and stands will be occupied by the leading firms in South Wales and the neighbouring county of Monmouth. A large stage, about 54 feet long, is being erected at the end of the hall, and upon it the Cardiff Gas Company have arranged to give paper-bag cookery lectures and demonstrations with the aid of gas-stoves. There will also be cooking demonstrations by means of electricity. Both will take place each afternoon and evening during the period of the exhibition.

The Bolton Gas Committee have accepted tenders for the supply of meters from the following firms: Parkinson and W. & B. Cowan, J. & J. Braddock, Alder and Mackay, and George Orme.

According to an article in the "Municipal Journal" by Mr. S. Hutton, the Surveyor and Water Engineer of the Exmouth Urban District Council, tar spraying has been done in the town since 1904, and the results are excellent; the cost of road maintenance having been reduced by £700 per annum.

In the Lancashire towns where a curtailment of public lighting was rendered necessary through the strike, coupled with a reduction of pressure and in some cases a restriction in the hours for domestic supply, the full quantity of gas was restored by the past week-end; corporations and gas companies being among the first to receive attention at the hands of colliery owners and agents with contracts running.

Owing to the failure of the dynamo at the General Post Office in Liverpool last Sunday night, the building was temporarily plunged in darkness. In a very few minutes lamps, which are always kept ready in case of emergency, and a large number of candles were procured, and work went on in all departments as usual, though naturally under disadvantageous conditions. It was some hours before the machine could be repaired.

The Directors of Newton, Chambers, and Co., Limited, in their report for the year ended Dec. 31 last, state that, after allowing for depreciation, the profit and loss account shows a profit for the year of £29,772—making, with the balance of £16,349 brought forward, a total of £46,121. Deducting debenture interest, there is an available balance of £43,095. The Directors recommend the transfer of £7000 to reserve account, a dividend of 6 per cent. on the preference shares, and one of 6 per cent. on the ordinary shares; carrying forward a balance of £17,707.

Evidence has just come to hand from the Antipodes that gas beats electricity in another domain than that of lighting. In the seventeenth annual match between the cricket teams of the Australian Gaslight Company and the electrical firms of Sydney, the Gas Company's team won by 54 runs—the figures being 196 and 142. The balance of victory has been with the representatives of electricity; but the gas men made their win a very happy occasion. The annual luncheon, at which there was a large gathering, was presided over by Mr. R. J. Lukey, the Secretary of the Gas Company.

While the St. Saviour's, Guildford, Easter Vestry were discussing the question of the installation of electrical apparatus for blowing a new organ, the electric light failed—leaving the meeting in total darkness; and the business had to be continued with the aid of a piece of candle.

In view of possible difficulties resulting from a strike of coal miners, the question of the adoption of plant for the production of carburetted water gas has been under consideration in a number of works; and we learn that Messrs. R. & J. Dempster, Limited, have recently received from the Chelmsford and Newton Abbot Gas Companies orders for plant of this type, which will embody the various improvements first introduced in the plants supplied for the New Mills and the Tyldesley Gas-Works.

Under the title of Wet Carbonizing, Limited, a Company has been registered with a capital of £255,000, in 250,000 preference shares of £1 and 100,000 ordinary shares of 1s. each, "to acquire, grant licences or rights in respect of, and turn to account, wet or dry carbonizing processes; processes for heating, drying, or for expelling and removing water and moisture; for separating, extracting, or depositing solids from liquids, gas, or vapour, or *vice versâ*; for extracting or producing gas, ammonia, nitrogen, sulphates, and the like; and for treating sewage and refuse and extracting products therefrom, and processes or methods for producing briquettes and other prepared blocks, and for gathering, excavating, and transporting materials." Also to treat, carbonize, prepare, manufacture, and deal in peat, waste wood, lignite, coal substances and briquettes, and patent or prepared blocks of all kinds for fuel or otherwise, from any substances or materials, &c.; and to adopt agreements with the Peat Coal Investment Company, Limited, the International Carbonizing Company, Limited, the E. P. F. Syndicate, Limited, and Messrs. Crossley Bros., Limited.

In view of the announcements appearing in the papers that towns in various parts of the country were having the public lighting reduced, the Chairman of the Street Lighting Committee of the Margate Corporation (Mr. E. J. Bryant) naturally became alarmed. His fears were allayed by an assurance from the Manager of the Gas Company, and also from Mr. J. A. Forde, who holds a similar position with the Electric Lighting Company, that they were prepared to meet the public demand for some weeks. On this assurance, he was able to call his Committee together with some confidence, and beyond deferring the lighting of the extra burner lamps for one month, they were able to keep up the usual lighting. In a letter to a local paper, he expressed his thanks to the two gentlemen named "for the tactful and business-like manner in which they met the exigencies of the coal crisis, and kept the town of Margate fully lighted." He also said it was satisfactory to note that the standard quality of the gas had been maintained. The same issue of the paper contained a prominent advertisement of the Gas Company advising the inhabitants to use gas, the "willing servant," whether for lighting, heating, or cooking.

APPLICATIONS FOR LETTERS PATENT.

7843-4.—Holliday, H. H., and Steven, A. K., "Fire-grates adapted to be used for either solid fuel or gas." April 1.
7849.—Lavington, C. D., "Supplying air or gas under pressure." April 1.
7914.—Bell, J. F., "Gas-furnaces for heating retorts." April 2.
7968.—Ehrich and Graetz, "Distance igniter for pressure gas lamps with multiple flames." April 2.
7987.—Fenlon, H. T., "Hot water heating." April 2.
8015.—Lyall, W. A., and Davis, H., "Measuring the velocity of flow, or the pressure, of air, steam, or gas." April 3.
8042.—Stobart, H. J. S., and Hendy, J., "Gas-burners." April 3.
8056.—Alston, C. H. T., and Houston, P. T., "Gas-producers." April 3.
8061.—Podmore, A. E., "Trap-doors for lamps." April 3.
8097.—Hunt, E. J., and Gidden, W. T., "Recovery of sulphur from mixtures containing tarry matters." April 3.
8131.—Horch, A., et Cie., "Gas-turbines." April 4.
8199.—Arndt, M., "Testing air and gases." April 4.
8217.—Burkheiser, K., "Making used gas purifying mass fit for re-use by roasting." April 4.
8260.—Keith, J. & G., "Igniting gas-burners." April 4.
8276.—Drennan, J., "Gas heating devices." April 6.
8284.—King, J., jun., Burnett, J. R., and the Richmond Gas Stove and Meter Company, Limited, "Gas and fuel burners." April 6.
8291.—Raistrick, J. W., "Portable gas-oven." April 6.
8344.—Shaw, E. J., "Gas-lamps." April 6.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

Chief Assistant. North Middlesex Gas Company. Applications by April 29.
Charge of Ruthin Gas and Water Companies. Applications to W. Ewart Brock, Denbigh, North Wales.
Assistant Superintendent (Water Company). No. 5549.
Draughtsman. No. 5553.
Draughtsman. No. 5554.
Working Manager. No. 5551.
Representative (Mainlaying, &c.). No. 5552.
Representative (Coal). No. 5545.
Show-Room Attendant. Weston-super-Mare Gas Company.
Fitter. No. 5550.

Appointments, &c., Wanted.

Manager, &c. No. 5546.
Secretary. No. 5548.

Agency for Continent (English Firm). Box 806, T. B. Browne's Advertising Offices.

Plant, &c. (Second-Hand), for Sale.

Fire Brigade Appliances, Gear, and Stores, &c. London County Council. Tenders by April 19.
Steam-Engine, Exhauster, Condensers, &c. Bury St. Edmunds Gas Company.

Plant, &c. (Second-Hand), Wanted.

Washer-Scrubber. Stanley Gas Company.

Gas-Works (Complete) for Disposal.

Cavan Gaslight Company. Tenders by May 10, to the Liquidator, T. R. Burns, 13, Donegall Square N., Belfast.

Meetings.

Imperial Continental Gas Association. Salisbury House. May 7. 2.30 o'clock.

Patent Licences, &c.

Distilling Crude Petroleum. Bakelite Company, Cowley, Middlesex.
Improvements in Gas-Engines. Haseltine, Lake, and Co., Southampton Buildings, Chancery Lane, W.C.
Pyrophoric Alloys. Abel and Imray, Birkbeck Chambers, W.C.

TENDERS FOR

Gasholder and Steel Tank.

Drogheda Gas Department. Tenders by May 2.

Pipes, &c.

Mossley Gas Department. Tenders by April 26.

Tubing (Composition and Tinned).

Glasgow Gas Department. Tenders by April 23.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

Wanted, For Sale, and Tender Advertisements, Six Lines and under, 3s.; each additional Line, 6d.

TERMS OF SUBSCRIPTION to the "JOURNAL."

United Kingdom: One Year, 21s.; Half Year, 10s. 6d.; Quarter, 6s. 6d.
Payable in advance. If credit is taken, the charge is 25s. a year.
Abroad (in the Postal Union): £1 7s. 6d., payable in advance.

All Communications, Remittances, &c., to be addressed to
WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.
Telegrams: "GASKING, LONDON." Telephone: P.O. 1571a Central.

OXIDE OF IRON.

O'NEILL'S OXIDE
For GAS PURIFICATION
LARGEST SALE OF ANY OXIDE.

SPENT OXIDE PURCHASED IN ANY DISTRICT.

GAS PURIFICATION & CHEMICAL CO., LD.,
PALMERSTON HOUSE,
OLD BROAD STREET, LONDON, E.C.

WINKELMANN'S
"VOLCANIC" FIRE CEMENT.
Resists 4500° Fahr. Best for GAS-WORKS.
ANDREW STEPHENSON, 182, Palmerston House, Old Broad Street, London, E.C. "Volcanism, London."

SULPHURIC ACID.

SPECIALLY prepared for Sulphate of AMMONIA Makers by
CHANCE AND HUNT, LIMITED,
Works: OLDBURY, WEDNESBURY, AND STAFFORD.
Address Correspondence and Inquiries to OLDBURY, WORCS.
Telegrams: "CHEMICALS, OLDBURY."

TAR WANTED.
THOMAS HORROCKS & SONS, LTD.,
Albert Chemical Works, BRADFORD,
MANCHESTER.
Pitch, Creosote, Brick and Fuel Oils, Benzol, Solvent Naphtha, Carbolic, Sulphate of Ammonia.

D. ANDERSON AND COMPANY,
GAS LIGHTING ENGINEERS AND CONTRACTORS,
18 & 20, FARRINGDON ROAD, LONDON, E.C.
Telegrams: "DACOLIGHT LONDON." Telephone: 2336 HOLBORN.

R. & G. HISLOP,
GAS ENGINEERS, RETORT BUILDERS, CONTRACTORS, &c.
RETORT SETTINGS, COAL TESTING PLANT, BOILER FIRING.
Communications should be addressed to UNDERWOOD HOUSE, PAISLEY.

BRISTOL'S RECORDING GAUGES.
THE MOST EXTENSIVE RANGE OF RECORDING INSTRUMENTS IN THE WORLD.

J. W. & C. J. PHILLIPS, LTD.,
23, COLLEGE HILL, CANNON STREET, LONDON, E.C.
Recording Pressure Gauges.
Recording Vacuum Gauges.
Combination Recording Pressure and Vacuum Gauges.
Recording Draught Gauges.
Recording Hydraulic Pressure Gauges.
Recording Water Level Gauges.
Recording Thermometers.
Indicating Electric Pyrometers.
Recording Electric Pyrometers.
Recording Milli Voltmeters for stray currents in gas-mains.
Long Distance Recording Tachometers, &c., &c.

AMMONIACAL Liquor wanted.
BROTHERTON AND CO., LTD. Ammonia Distillers.
Works: BIRMINGHAM, GLASGOW, LEEDS, LIVERPOOL, SUNDERLAND, AND WAKEFIELD.

J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, OLDHAM, and 45 & 47, Westminster Bridge Road, LONDON, S.E.
WET AND DRY GAS-METERS, PREPAYMENT METERS, STATION METERS AND GOVERNORS.
REPAIRS RECEIVE PROMPT ATTENTION.
Telephones: 815 Oldham, and 2412 Hop, London.
Telegrams—
"BRADDOCK, OLDHAM," and "METRIQUE, LONDON."

BENZOL
AND
CARBURINE FOR GAS ENRICHING.
ALSO
THE MAXIM PATENT CARBURETTOR.
For Prices, &c., apply to
THE GAS LIGHTING IMPROVEMENT CO., LTD.
126, BISHOPSGATE, E.C.
Telegraphic Address: "Carburine, London."

SPENCER'S PATENT HURDLE GRIDS.

THE very best Patent Grids for Holding Oxide Lightly.
See Illustrated Advertisement, April 2, p. 7.

SULPHURIC ACID — Specially prepared for Sulphate of AMMONIA and BENZOL Recovery Plants. JOHN NICHOLSON & SONS, LTD., Hunslet Chemical Works, LEEDS. Tele.: "NICHOLSON, LEEDS." Telephone: (Two lines), Nos. 2420 and 2421.

SULPHATE OF AMMONIA SATURATORS and all LEAD and TIMBER WORK in Connection with Sulphate Plants.
We guarantee promptness with efficiency for Repairs.
JOSEPH TAYLOR AND CO., CENTRAL PLUMBING WORKS, BOLTON.
Telegrams: "SATURATORS, BOLTON." Telephone 0848.

GAS-WORKS requiring Extensions should Communicate with FIRTH BLAKELEY, SONS, AND CO., LIMITED, Dewsbury, who make a Speciality of Catering for the Smaller Gas Concerns. Prices Reasonable; quality and results, the *best*. Satisfaction Guaranteed.

HYDRATED OXIDE OF IRON.

PREPARED from Pure Iron.
Twice as rich as Bog Ore.
Gives no back Pressure.
The Cheapest in the Market.
READ HOLLIDAY AND SONS, LTD., HUDDERSFIELD.

INVENTIONS.—Before protecting your idea send for free copy of our "GUIDE TO PATENTS." (1912 Edition). Full advice given on any subject—no trouble spared. Original testimonials for inspection. Highest references. Compare our inclusive fees.—WITHERS & SPOONER, Chartered Patent Agents, 323, High Holborn, LONDON, Estab. 28 years.

AMMONIA Waste Liquor Disposal.
Purification Plant.
Results Guaranteed. No Working Costs.
JOHN RADCLIFFE AND CO., Chemists and Engineers, Palace Chambers, WESTMINSTER, S.W.

AMMONIACAL Liquor wanted.
CHANCE AND HUNT, LTD., Chemical Manufacturers, OLDBURY, WORCS.
Telegrams: "CHEMICALS."

GAS PLANT for Sale—We can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
FIRTH BLAKELEY, SONS, AND COMPANY, LIMITED, Church Fenton, near LEEDS.

COAL TAR wanted.
BROTHERTON AND CO., LTD., Tar Distillers.
Works: BIRMINGHAM, GLASGOW, LEEDS, LIVERPOOL, SUNDERLAND, AND WAKEFIELD.

OXIDE OF IRON.
SPENT OXIDE PURCHASED.
BALE'S FIRE CEMENT.
PAINT FOR GAS-WORKS.
"KLEENOFF," THE COOKER CLEANER.
BALE & CHURCH, LTD.,
5, CROOKED LANE, LONDON, E.C.

SULPHURIC ACID.

SPECIALLY prepared for the Manufacture of SULPHATE OF AMMONIA.
SPENCER CHAPMAN & MESSEL, LTD.,
with which is amalgamated WM. PEARCE & SONS, LTD.
36, Mark Lane, LONDON, E.C. Works: SILVERTOWN.
Telegrams: "HYDROCHLORIC, LONDON."
Telephone: 1588 AVENUE (3 lines).

FOR Instructions on Polishing and Cleaning Gas-Cookers and Gas-Fittings, read Canning Handbook on Polishing, Electro-Plating, and Lacquering. Fully illustrated. Price 2s. 3d., post free; abroad, 2s. 6d.
W. CANNING AND CO., BIRMINGHAM, and 18 to 20, St. John's Square, Clerkenwell, LONDON, E.C.

BROTHERTON & CO., LIMITED.
Offices: City Chambers, LEEDS.
Correspondence invited.

AMMONIA.
Consumers in any form are invited to correspond with CHANCE AND HUNT, LTD., Chemical Manufacturers, OLDBURY, WORCS.

PATENTS AND TRADE MARKS
PUBLICATIONS: "MERCHANDISE MARKS ACT, and Decisions thereunder," 1s.; "TRADE SECRETS v. PATENTS," 6d.; "DOCTRINE of EQUIVALENTS, Mechanical and Chemical," 6d.; "SUBJECT-MATTER of PATENTS," 6d.
MEWBURN, ELLIS, & PRYOR, Chartered Patent Agents, 70 & 72, Chancery Lane, London, W.C. Telegrams: "Patent London." Telephone: No. 243 Holborn.

TAR WANTED.
THE Burnden Tar Company (Bolton), Ld.,
HULTON CHEMICAL WORKS, BOLTON.
JOSEPH A. HUTCHISON, Managing Director.

J. E. C. LORD, Ship Canal Tar-Works, Weaste, Manchester. Pitch, Creosote, Benzols, Toluol, Naphtha, Pyridine, all kinds of Cresylic Acid, Carbolic Acid, Sulphate of Ammonia, &c.

SULPHURIC ACID for Sale, specially suitable for making Sulphate of Ammonia.
BROTHERTON AND CO., LTD., Chemical Manufacturers. Works: BIRMINGHAM, LEEDS, SUNDERLAND, AND WAKEFIELD.

"GAZINE" (Registered in England and Abroad). A radical Solvent and Preventative of Naphthalene Deposits, and for the Automatic Cleaning of Mains and Services.
It is also used for the Enrichment of Gas.
Manufactured and supplied by C. BOURNE, West Moor Chemical Works, KILLINGWORTH, or through his Agent, F. J. NICOL, Pilgrim House, NEWCASTLE-ON-TYNE.
Telegrams: "DORIC," Newcastle-on-Tyne. National Telephone No. 2497.

TO GAS AND WATER OFFICIALS.

BEFORE Purchasing your 1912 Cycle, kindly send post-card for our CATALOGUE, Cash or gradual Payments. Speciality, Slot-Meter Copper Collector. MELROSE CYCLE CO., COVENTRY.

OLD-ESTABLISHED English Engineering Firm, owning largely-used Appliances for Gas-Works, with own Staff Representative (Linguist) Travelling constantly on the Continent, are open to consider AGENCY FOR CONTINENT, on Mutual Basis, for First-Class British Speciality.
Write to Box 806, T. B. BROWNE'S ADVERTISING OFFICES, 163, Queen Victoria Street, LONDON.